SUMMARY OF
2006 SEATTLE ENERGY CODE PROPOSAL

On 17 November 2006, the Washington State Building Code Council adopted changes to the Washington State Energy Code that take effect on 1 July 2007. Consequently, Seattle must update the Seattle Energy Code. The proposed 2006 Seattle Energy Code consists of the 2006 Washington State Energy Code with Seattle amendments to the nonresidential provisions. While the first comprehensive Seattle Energy Code took effect in February 1980, Seattle has had residential insulation requirements since 1974 and the first furnace sizing and duct insulation requirements took effect in 1927. Seattle has regularly updated its Energy Code to incorporate changes in technology and to improve implementation. Resolution 30280 also provides direction for Seattle Energy Code updates.

Goals for this Update Cycle

Seattle amendments to the 2006 Washington State Energy Code (WSEC) are proposed:

- to achieve the energy savings specified in Resolution 30280, and
- to improve implementation of existing amendments.

Resolution 30280 (Section 1.B.i) directs DPD and Seattle City Light to "propose to the City Council…amendments to the Seattle Energy Code…to achieve up to 20% enhanced energy efficiency beyond the current version of ASHRAE/IESNA Standard 90.1". The 2004 Seattle Energy Code achieved approximately 20% energy savings compared to ASHRAE/IESNA Standard 90.1-1999. However, since that time, ASHRAE/IESNA Standard 90.1-2004 has been published and it contains significant energy efficiency improvements (particularly in lighting). Consequently, it is estimated that the existing Seattle Energy Code only achieves 10% energy savings compared to ASHRAE/IESNA Standard 90.1-2004. Therefore, for the 2006 Seattle Energy Code update, the net energy savings from new amendments would be 10%.

Public Review Process

City staff presented the proposals at four public meetings in February (February 1 – overview, building envelope, and lighting; February 8 – mechanical and RS-29; February 15 – carryover issues; and February 22 – new issues in public comments). In addition, presentations were made to professional organizations (January 18 – IES Puget Sound Chapter; January 22 – ASHRAE Puget Sound Chapter; February 7 – AIA Seattle Chapter; and February 15 – BOMA Seattle King County). The written comment deadline was February 20.

Staff made a number of revisions in response to issues raised. The most significant change was to not recommend a second tier of higher mechanical equipment efficiencies. However, without the energy savings from mechanical equipment efficiencies, the original draft package of measures for the 2006 Seattle Energy Code would not have achieved the 20% energy savings specified in Resolution 30280. Consequently, DPD staff developed a supplemental draft of Seattle amendments to the 2006 Washington State Energy Code. That supplemental draft for a limited number of sections in Chapter 14 was discussed at a public review meeting on March 13.

Some further modifications were made to those sections based on comments received and were included in the version reviewed by CCAB.

In summary, the changes proposed by staff were refined through public review and endorsed by the DPD Construction Codes Advisory Board at their meeting on 15 March 2007. DPD expresses its gratitude for all of those who participated in this process. Their efforts will result in a Seattle Energy Code that is more workable for all.

Code Language Proposals

Consistent with the 2004 Seattle Energy Code, the 2006 Seattle Energy Code (the update to be adopted this spring and effective this summer) consists of the 2006 Washington State Energy Code (WSEC) with Seattle amendments to the nonresidential sections. As is the case with the 2004 Seattle Energy Code, there are no Seattle amendments to the residential sections (though the Washington State Building Code Council did adopt residential amendments that are in the 2006 WSEC and that are filed in Washington State Register WSR 07-01-089).

All of the Seattle amendments are summarized below in section number order and include:

- **Section number and title.**
- *Discussion:* This contains a summary of the issues and the source of the language if it has been taken from another document, such as ASHRAE/IESNA Standard 90.1-2004. (Standard 90.1 is cited in the 1992 National Energy Policy Act as the basis for Energy Codes in all 50 states. Previous versions of the Seattle Energy Code have drawn substantially from this document and its predecessors.)
  - "No Seattle changes (retain existing Seattle amendment)" indicates that the 2006 Seattle amendment is the same as an existing 2004 Seattle amendment, or revised only to reflect partial adoption into the 2006 Washington State Energy Code.
  - Changes to Seattle amendments or new Seattle amendments are shown by a bar in the margin. (For changes in tables, the bar in the margin is shown next to the title of the table.)
- *Proposal:* This contains the proposed text. All strikethroughs and underlines show changes from the 2006 Washington State Energy Code, <u>not</u> changes from the existing Seattle Energy Code.

Existing Seattle Amendments to be Retained – No Changes

The Seattle amendments to the following sections and tables are proposed to be retained with no changes:

Table 10-5B Default U-Factors for Concrete and Masonry Walls.
1133 Change of Occupancy or Use.
1144 Violations and Penalties.
1150 Conflicts With Other Codes.
1161 Severability.
1162 Liability.

1301 Building Envelope Scope.
1311.6 Radiant Floors.
1312.2 Solar Heat Gain Coefficient and Shading Coefficient.
1322 Opaque Envelope.
1323 Glazing.
1333 UA Calculations.
1402 Mechanical Ventilation.
1412.6 Heating System Controls.
1413 Economizer.
1414 Ducting Systems.
1431.2 System Sizing Limits.
1435 Simultaneous Heating and Cooling.
1436 Heat Recovery.
1437 Electric Motor Efficiency.
1440 Service Water Heating.
1452 Pool Water Heaters.
1513.1 Local Control and Accessibility.
1513.3 Daylight Zone Control.

RS-29, Section 3.4, HVAC Systems and Equipment.
RS-29, Section 3.6, Controls.
RS-29, Table 3-3, HVAC Systems of Prototype Buildings.

Existing Seattle Amendments to be Retained – Minor Changes

The Seattle amendments to the following sections were partially adopted into the 2006 Washington State Energy Code and are modified to reflect that partial adoption:

701 Reference Standards.
1132.3 Lighting and Motors Alterations.
1331 Component Performance Option.
1411 HVAC Equipment Performance.
1412.4 Setback and Shutoff Controls.
1433 Economizer.
1512 Exempt Lighting.
1532 Exterior Lighting Power Allowance.

Existing Seattle Amendments No Longer Needed – State Adoption

The previous Seattle amendments to the following sections have been incorporated into the 2006 Washington State Energy Code and so are no longer needed:

Table 10-5A Default U-Factors for Metal Stud Walls.
Table 10-6 Other than Group R Occupancy: Default U-Factors for Vertical Glazing, Overhead Glazing and Opaque Doors.
1132.2 & Table 11-1 Alterations to Building Mechanical Systems.

1310.2 Semi-Heated Spaces.
1412.2 Deadband Controls.
1412.8 Ventilation Controls for High Occupancy Areas *(formerly 1412.9)*.
1416 Mechanical Systems Completion and Commissioning Requirements.
1432.2.2 Hydronic Systems.
1501 Scope.
1510 General.
1513.5 Automatic Shut-Off Controls, Exterior.
1530 Lighting Power Allowance Option.
1540 Transformers.
Table 15-1 Interior Lighting Power Allowances.

Proposed Amendments

Amendments are proposed for the following:

- 201: Clarify documentation for insulation materials, add definition of building entrance as a companion change to air leakage.
- 1001.5: Add table of default R-values for commonly used building materials.
- 1005.1: Provide individual table numbering, expand default options for peripheral edges of intermediate concrete floors, and add table of default U-factors for metal building walls.
- 1007.1: Provide individual table numbering, add table of default U-factors for metal building roofs, and add table with default U-factors for roofs with insulation entirely above deck.
- 1132.2: Clarify application to computer room equipment in mechanical system alterations, air-handling units located outdoors, and chiller efficiency improvements.
- 1310.2: Clarify that semi-heated spaces are calculated separately from other conditioned spaces.
- 1314: Modify to better address air leakage per ASHRAE/IESNA Standard 90.1, addendum c, and IECC 502.4.2.
- 1322: Revise exceptions 2 & 3 for consistency with Tables 10-7G and 13-1.
- Table 13-1: Increase insulation levels and improve glazing heating and cooling performance.
- 1411.1: Modify exception so that chillers designed for non-standard conditions must show compliance with the nearest value in table; and address equipment not rated.
- 1411.5: Revise to require occupancy sensor to reduce energy waste.
- 1412.4.1: Revise exceptions for non-motorized dampers for consistency with Standard 90.1.
- 1412.9 *(formerly Section 1412.8)*: Delete existing Seattle amendment and refer to the Seattle Mechanical Code as this issue is now addressed in Section 404 of that document.
- 1413.1: Clarify when waterside economizer is allowed to be used.

- 1420-1423: Delete simple systems section to create consistent requirements for all system types.
- 1431.2: Provide prescriptive sizing option in exception 4
- 1433: Revise exemptions to lower threshold to 33,000 Btuh, lower total capacity of all units without economizers, and add clarifying note; revise to only exempt open refrigerator cases.
- 1436.1: Set thresholds for different outside air supply rates.
- 1438: Revise to require variable speed drive for all fans and pumps of 7.5 hp and larger.
- 1454: Require the side and bottom surfaces of spas to be insulated.
- Tables 14-1C and 14-1K, 14-1L, and 14-1M: Increase minimum efficiencies for chillers and corresponding changes to Tables14-1K, 14-1L, and 14-1M.
- Table 14-1G: Clarify application.
- 1512.2: Clarify application to furniture-mounted task lighting.
- Table 15-1: Reduce lighting power allowances to 0.95 W/ft^2 for office and to 2.7 W/ft^2 (1.5 + 1.2) for retail spaces over 3,000 ft^2, insert "ceramic metal halide and other" HID.
- RS-29, Section 3.3.1: Standard Design glazing area to be same as proposed for small window areas and to use metal stud wall construction.
- RS-29, Section 3.4.4: Standard Design fan system to comply with ASHRAE Standard 90.1.
- RS-29, Table 3-3: Standard Design to not have electric resistance space heat and to have chilled water systems.

201 General Definitions.

Discussion: (1) Add definition of building entrance as a companion change to air leakage; (2) Clarify documentation for nominal R-value for insulation materials.

Proposal: Amend 2006 WSEC as follows -

201 General Definitions.

…

BUILDING ENTRANCE: any doorway, set of doors, turnstile, vestibule, or other form of portal that is ordinarily used to gain access to the building by its users and occupants.

…

NOMINAL R-VALUE: The thermal resistance of the insulation alone as determined in accordance with the U.S. Federal Trade Commission R-value rule (CFR Title 16, Part 460) in units of $h \cdot ft^2 \cdot °F/Btu$ at a mean temperature of 75°F. Nominal R-value refers to the thermal resistance of the added insulation in framing cavities or insulated sheathing only and does not include the thermal resistance of other building materials or air films.

For products not labeled in accordance with the FTC rule, the R-value is to be determined by a report from the ICC Evaluation Service (ICC-ES).

…

701 Standards.

Discussion: Revise existing amendment only to reflect partial adoption into the 2006 Washington State Energy Code.

Proposal: Amend 2006 WSEC as follows -

701 – Standards.

The following standards shall apply to Chapters 1 through 20. The standards and portions thereof, which are referred to in various parts of this Code shall be part of the Washington State Energy Code and are hereby declared to be a part of this Code.

CODE STANDARD NO.	TITLE AND SOURCE
RS-1	2005 ASHRAE Fundamentals Handbook.
RS-2	Super Good Cents Technical Reference (Builder's Field Guide).
RS-3:	(Reserved.)
RS-4	ASHRAE Standard 55-2004 Thermal Environmental Conditions for Human Occupancy.
RS-5	2006 ASHRAE Refrigeration Handbook.
RS-6	SMACNA, Installation Standards for Residential Heating and Air Conditioning Systems, 6th Edition, 1988.
RS-7	SMACNA, HVAC Duct Construction Standards Metal and Flexible, 2nd Edition, 1995.
RS-8	SMACNA, Fibrous Glass Duct Construction Standards, 6th Edition, 1992.
RS-9	ASHRAE/IESNA Standard 90.1-2004, Energy Standard for Buildings Except Low-Rise Residential Buildings.
RS-10	2004 ASHRAE Systems & Equipment Handbook.
RS-11	2003 ASHRAE HVAC Applications Handbook.
RS-12 through RS-28:	(Reserved.)
RS-29	Nonresidential Building Design by Systems Analysis.
RS-30	Title 10, Code of Federal Regulations (CFR), Part 430 (March 14, 1988).
RS-31	National Fenestration Rating Council (NFRC) Standard 100-2004.
RS-32	Seattle EnvStd 2006, available for download at the Seattle Energy Code homepage at: http://www.seattle.gov/dpd/energy

ACCREDITED AUTHORITATIVE AGENCIES

ANSI refers to the American National Standards Institute, Inc., 11 West 42nd Street, New York, NY 10036
Phone (212) 642-4900 Fax (212) 398-0023, Internet www.ansi.org

ARI refers to the Air-Conditioning and Refrigeration Institute, 4301 N. Fairfax Dr., Suite 425, Arlington, VA 22203
Phone (703) 524-8800 Fax (703) 528-3816, Internet www.ari.org

ASHRAE refers to the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 1791 Tullie Circle, N.E., Atlanta, GA 30329
Phone (404) 636-8400 Fax (404) 321-5478, Internet www.ashrae.org

ASTM refers to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959
Phone (610) 832-9585 Fax (610) 832-9555, Internet www.astm.org

CTI refers to the Cooling Tower Institute, 530 Wells Fargo Drive, Suite 218, Houston, TX 77090
Phone (281) 583-4087 Fax (281) 537-1721, Internet www.cti.org

IESNA refers to the Illuminating Engineering Society of North America, 120 Wall Street, Floor 17, New York, NY 10005-4001
Phone (212) 248-5000 Fax (212) 248-5017, Internet www.iesna.org

NFRC refers to the National Fenestration Rating Council, Inc., 8484 Georgia Avenue, Suite 320, Silver Spring, Maryland 20910
Phone (301) 589-1776 Fax (301) 589-3884, Internet www.nfrc.org

SMACNA refers to the Sheet Metal and Air Conditioning Contractors National Association, Inc., 4201 Lafayette Center Drive, P.O. Box 221230, Chantilly, VA 20153-1230
Phone (703) 803-2980 Fax (703) 803-3732, Internet www.smacna.org

1001 General.

Discussion: Add table of default R-values for commonly used building materials.
Proposal: Amend 2006 WSEC as follows -

1001 General.

1001.1 Scope: The following defaults shall apply to Chapters 1 through 20. This chapter includes tables of seasonal average heat loss coefficients for specified nominal insulation. The heat loss coefficients may also be used for heating system sizing.

1001.2 Description: These coefficients were developed primarily from data and procedures from Standard RS-1, and taken specifically from Standard RS-2, listed in Chapter 7.

Coefficients not contained in this chapter may be computed using the procedures listed in these references if the assumptions in the following sections and Standard RS-2, listed in Chapter 7, are used, along with data from the sources referenced above.

1001.3 ((~~Air Films:~~ ~~Default R-values used for air films shall be as follows:~~

~~R-Value Condition~~
~~0.17 All exterior surfaces~~
~~0.61 Interior horizontal surfaces, heat flow up~~
~~0.92 Interior horizontal surfaces, heat flow down~~
~~0.68 Interior vertical surfaces~~)) Reserved.

1001.4 Compression of Insulation: Insulation which is compressed shall be rated in accordance with Table 10-A or reduction in value may be calculated in accordance with the procedures in Standard RS-1, listed in Chapter 7.

TABLE 10-A
R-VALUE OF FIBERGLASS BATTS COMPRESSED WITHIN VARIOUS DEPTH CAVITIES

Insulation R-Values at Standard Thickness

R-Value		**38**	**30**	**22**	**21**	**19**	**15**	**13**	**11**	**8**	**5**	**3**
Standard Thickness		**12”**	**9-1/2”**	**6-3/4”**	**5-1/2”**	**6-1/4”**	**3-1/2”**	**3-5/8”**	**3-1/2”**	**2-1/2”**	**1-1/2”**	**3/4"**
Nominal Lumber Sizes, Inches	Actual Depth of Cavity, Inches	Insulation R-Values When Installed in a Confined Cavity										
2x12	11-1/4	37	—	—	—	—	—	—	—	—	—	—
2x10	9-1/4	32	30	—	—	—	—	—	—	—	—	—
2x8	7-1/4	27	26	—	—	—	—	—	—	—	—	—
2x6	5-1/2	—	21	20	21	18	—	—	—	—	—	—
2x4	3-1/2	—	—	14	—	13	15	13	11	—	—	—
2x3	2-1/2	—	—	—	—	—	—	9.8	—	—	—	—
2x2	1-1/2	—	—	—	—	—	—	6.3	6.0	5.7	5.0	—

2x1	3/4	—	—	—	—	—	—	—	—	—	3.2	3.0

1001.5 Building Materials: Default R-values used for building materials shall be as shown in Table 10-B.

TABLE 10-B DEFAULT R-VALUES FOR BUILDING MATERIALS

Material	Nominal Size (in.)	Actual Size (in.)	R-Value (Heat Capacity)
Air cavity (unventilated), between metal studs at 16 inches on center[1]	-	-	0.79
Air cavity (unventilated), all other depths and framing materials[1]	-	-	0.91
Airfilm, exterior surfaces[2]	-	-	0.17
Airfilm, interior horizontal surfaces, heat flow up[2]	-	-	0.61
Airfilm, interior horizontal surfaces, heat flow down[2]	-	-	0.92
Airfilm, interior vertical surfaces[2]	-	-	0.68
Brick at R-0.12/in.	4	-	0.48
Carpet and rubber pad	-	-	1.23
Concrete at R-0.0625/in.	-	2	0.13 (HC-4.8)
	-	4	0.25 (HC-9.6)
	-	6	0.38 (HC-14.4)
	-	8	0.50 (HC-19.2)
	-	10	0.63 (HC-24.0)
	-	12	0.75 (HC-28.8)
Concrete masonry units, solid grouted, lightweight (95 lbs/ft^3)	6	-	0.80 (HC-11.4)
Concrete masonry units, solid grouted, normal weight (135 lbs/ft^3)	6	-	0.51 (HC-13.2)
Concrete masonry units, partly grouted, lightweight (95 lbs/ft^3)	6	-	1.33 (HC-6.7)
Concrete masonry units, partly grouted, normal weight (135 lbs/ft^3)	6	-	0.82 (HC-9.0)
Concrete masonry units, solid grouted, lightweight (95 lbs/ft^3)	8	-	1.05 (HC-15.5)
Concrete masonry units, solid grouted, normal weight (135 lbs/ft^3)	8	-	0.69 (HC-17.9)
Concrete masonry units, partly grouted, lightweight (95 lbs/ft^3)	8	-	1.44 (HC-9.6)
Concrete masonry units, partly grouted, normal weight (135 lbs/ft^3)	8	-	0.98 (HC-12.0)
Concrete masonry units, solid grouted, lightweight (95 lbs/ft^3)	10	-	1.30 (HC-19.7)
Concrete masonry units, solid grouted, normal weight (135 lbs/ft^3)	10	-	0.87 (HC-22.6)
Concrete masonry units, partly grouted, lightweight (95 lbs/ft^3)	10	-	1.61 (HC-11.9)
Concrete masonry units, partly grouted, normal weight (135 lbs/ft^3)	10	-	1.11 (HC-14.8)
Concrete masonry units, solid grouted, lightweight (95 lbs/ft^3)	12	-	1.53 (HC-23.9)
Concrete masonry units, solid grouted, normal weight (135 lbs/ft^3)	12	-	1.06 (HC-27.2)
Concrete masonry units, partly grouted, lightweight (95 lbs/ft^3)	12	-	1.75 (HC-14.2)
Concrete masonry units, partly grouted, normal weight (135 lbs/ft^3)	12	-	1.23 (HC-17.5)
Flooring, wood subfloor	-	0.75	0.94
Gypsum board	-	0.5	0.45

	-	0.625	0.56
Metal deck	-	-	0
Roofing, built-up	-	0.375	0.33
Sheathing, vegetable fiber board, 0.78 in.	-	0.78	2.06
Soil at R-0.104/in.	-	12	1.25
Steel, mild		1	0.0031807
Stucco	-	0.75	0.08
Wood, 2 × 4 at R-1.25/in.	4	3.5	4.38
Wood, 2 × 6 at R-1.25/in.	6	5.5	6.88
Wood, 2 × 8 at R-1.25/in.	8	7.25	9.06
Wood, 2 × 10 at R-1.25/in.	10	9.25	11.56
Wood, 2 × 12 at R-1.25/in.	12	11.25	14.06
Wood, 2 × 14 at R-1.25/in.	14	13.25	16.56

[1] There is no credit for cavities that are open to outside air.
[2] Air films do not apply to air cavities within an assembly.

1005 Above Grade Walls.

Discussion: (1) Revise existing amendment to reflect partial adoption into the 2006 Washington State Energy Code; (2) Provide individual table numbering for ease of reference; (3) Expand options in table with default U-factors for peripheral edges of intermediate concrete floors, (4) Add table with default U-factors for metal building walls from ASHRAE/IESNA Standard 90.1-2004, Table A3.2.

Proposal: Amend 2006 WSEC as follows -

SECTION 1005 — ABOVE-GRADE WALLS

1005.1 General: Table 10-5, 10-5A and 10-5B list heat loss coefficients for the opaque portion of above-grade wood stud frame walls, metal stud frame walls and concrete masonry walls (Btu/h•ft^2•°F) respectively. They are derived from procedures listed in Standard RS-1, listed in Chapter 7. For intermediate floor slabs which penetrate the insulated wall, use the concrete wall U-factors in Table 10-5B(5).

Insulation is assumed to uniformly fill the entire cavity and to be installed as per manufacturer's directions. All walls are assumed to be finished on the inside with 1/2 inch gypsum wallboard, and on the outside with either beveled wood siding over 1/2 inch plywood sheathing or with 5/8 inch T1-11 siding. Insulated sheathing (either interior or exterior) is assumed to cover the entire opaque wall surface.

Metal building walls have a different construction and are addressed in Table 10-5A(3).

1005.2 Framing Description: For wood stud frame walls, three framing types are considered and defined as follows:

Standard: Studs framed on 16 inch centers with double top plate and single bottom plate. Corners use three studs and each opening is framed using two studs. Headers consist of double

2x or single 4x material with an air space left between the header and the exterior sheathing. Interior partition wall/exterior wall intersections use two studs in the exterior wall.

Standard framing weighting factors:

Studs and plates	0.19
Insulated cavity	0.77
Headers	0.04

Intermediate: Studs framed on 16 inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and each opening is framed by two studs. Headers consist of double 2x material with R-10 insulation between the header and exterior sheathing. Interior partition wall/exterior wall intersections are fully insulated in the exterior wall.

Intermediate framing weighting factors:

Studs and plates	0.18
Insulated cavity	0.78
Headers	0.04

Advanced: Studs framed on 24 inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header. Headers consist of double 2x material with R-10 insulation between the header and exterior sheathing. Interior partition wall/exterior wall intersections are fully insulated in the exterior wall.

Advanced Framing Weighting Factors:

Studs and plates	0.13
Insulated cavity	0.83
Headers	0.04

1005.3 Component Description: Default coefficients for ((~~four~~))the following types of walls are listed: single-stud walls, ((~~metal stud walls,~~))strap walls, and double-stud walls, log walls, stress-skin panels, metal stud walls, metal building walls,.

Single-Stud Wall, Tables 10-5(1)-(8): Assumes either 2x4 or 2x6 studs framed on 16 or 24 inch centers. Headers are solid for 2x4 walls and double 2x for 2x6 walls, with either dead-air or rigid-board insulation in the remaining space.

((~~Metal Stud Wall: Assumes metal studs spaced on 16 or 24 inch centers with insulation installed to fill wall cavities. Continuous rigid board insulation is applied without creating uninsulated voids in the wall assembly.~~))

Strap Wall, Table 10-5(9): Assumes 2x6 studs framed on 16 or 24 inch centers. 2x3 or 2x4 strapping is run horizontally along the interior surface of the wall to provide additional space for insulation.

Double-Stud Wall, Tables 10-5(10)-(11): Assumes an exterior structural wall and a separate interior, non-structural wall. Insulation is placed in both wall cavities and in the space between the two walls. Stud spacing is assumed to be on 24 inch centers for both walls.

Log Wall, Table 10-5(12).

Stress-Skin Panel, Table 10-5(13).

Metal Stud Wall, Overall Assembly U-Factors, Table 10-5A(1): Assumes metal studs spaced on 16 or 24 inch centers with insulation installed to fill wall cavities. Continuous rigid board insulation is applied without creating uninsulated voids in the wall assembly.

Metal Stud Wall, Effective R-Values for Metal Framing and Cavity Only, Table 10-5A(2): These values may be used for the metal-framing/cavity layer in walls metal studs spaced on 16 or 24 inch centers with insulation installed to fill wall cavities in lieu of using the zone method provided in Chapter 25 of Standard RS-1 listed in Chapter 7.

Metal Building Wall, Table 10-5A(3): A wall whose structure consists of metal spanning panels supported by steel structural members (does not include spandrel glass or metal panels in curtain wall systems). The first nominal R-Value is for insulation compressed between metal wall panels and the steel structure. For double-layer installations, the second rated R-value of insulation is for insulation installed from the inside, covering the girts. For continuous insulation (e.g., insulation boards) it is assumed that the insulation boards are installed on the inside of the girts and uninterrupted by the framing members. Insulation exposed to the conditioned space or semiheated space shall have a facing, and all insulation seams shall be continuously sealed to provide a continuous air barrier.

Concrete Masonry, 8", Table 10-5B(1a). Group R occupancy.

Concrete Masonry, 12", Table 10-5B(1b). Group R occupancy.

Clay Brick, 8", Table 10-5B(1c). Group R occupancy.

Concrete, 6" Poured or Precast, Table 10-5B(1d). Group R occupancy.

Peripheral Edges of Intermediate Concrete Floors, Table 10-5B(1e). Group R occupancy and other than Group R occupancy.

Concrete and Masonry Walls, Table 10-5B(2). Other than Group R occupancy.

TABLE 10-5
DEFAULT U-FACTORS FOR ABOVE-GRADE WALLS

TABLE 10-5(1)
2 x 4 Single Wood Stud:
R-11 Batt

NOTE:

Nominal Batt R-value:
R-11 at 3.5 inch thickness

Installed Batt R-value:
R-11 in 3.5 inch cavity

Siding Material/Framing Type				
	Lapped Wood		T1-11	
R-value of Foam Board	STD	ADV	STD	ADV
0	0.088	0.084	0.094	0.090
1	0.080	0.077	0.085	0.082
2	0.074	0.071	0.078	0.075
3	0.069	0.066	0.072	0.070
4	0.064	0.062	0.067	0.065
5	0.060	0.058	0.063	0.061
6	0.056	0.055	0.059	0.057

7	0.053	0.052	0.055	0.054
8	0.051	0.049	0.052	0.051
9	0.048	0.047	0.050	0.049
10	0.046	0.045	0.047	0.046
11	0.044	0.043	0.045	0.044
12	0.042	0.041	0.043	0.042

TABLE 10-5(2)
2 x 4 Single Wood Stud:
R-13 Batt

NOTE:
Nominal Batt R-value:
R-13 at 3.63 inch thickness

Installed Batt R-value:
R-12.7 in 3.5 inch cavity

Siding Material/Framing Type				
	Lapped Wood		T1-11	
R-value of Foam Board	STD	ADV	STD	ADV
0	0.082	0.078	0.088	0.083
1	0.075	0.072	0.080	0.076
2	0.069	0.066	0.073	0.070
3	0.065	0.062	0.068	0.065
4	0.060	0.058	0.063	0.061
5	0.057	0.055	0.059	0.057
6	0.053	0.052	0.056	0.054
7	0.051	0.049	0.052	0.051
8	0.048	0.047	0.050	0.048
9	0.046	0.045	0.047	0.046
10	0.044	0.043	0.045	0.044
11	0.042	0.041	0.043	0.042
12	0.040	0.039	0.041	0.040

TABLE 10-5(3)
2 x 4 Single Wood Stud:
R-15 Batt

NOTE:
Nominal Batt R-value:
R-15 at 3.5 inch thickness

Installed Batt R-value:
R-15 in 3.5 inch cavity

Siding Material/Framing Type				
	Lapped Wood		T1-11	
R-value of Foam Board	STD	ADV	STD	ADV
0	0.076	0.071	0.081	0.075
1	0.069	0.065	0.073	0.069
2	0.064	0.061	0.068	0.069
3	0.060	0.057	0.063	0.059
4	0.056	0.053	0.059	0.056
5	0.053	0.051	0.055	0.052
6	0.050	0.048	0.052	0.050
7	0.047	0.046	0.049	0.047
8	0.045	0.044	0.047	0.045
9	0.043	0.042	0.044	0.043
10	0.041	0.040	0.042	0.041
11	0.039	0.038	0.041	0.039
12	0.038	0.037	0.039	0.038

TABLE 10-5(4)
2 x 6 Single Wood Stud: R-19 Batt

NOTE:
Nominal Batt R-value:
R-19 at 6 inch thickness

Installed Batt R-value:
R-18 in 5.5 inch cavity

Siding Material/Framing Type						
	Lapped Wood			T1-11		
R-value of Foam Board	STD	INT	ADV	STD	INT	ADV
0	0.062	0.058	0.055	0.065	0.061	0.058
1	0.058	0.055	0.052	0.060	0.057	0.055
2	0.054	0.052	0.050	0.056	0.054	0.051
3	0.051	0.049	0.047	0.053	0.051	0.049
4	0.048	0.046	0.045	0.050	0.048	0.046
5	0.046	0.044	0.043	0.048	0.046	0.044
6	0.044	0.042	0.041	0.045	0.044	0.042
7	0.042	0.040	0.039	0.043	0.042	0.040
8	0.040	0.039	0.038	0.041	0.040	0.039
9	0.038	0.037	0.035	0.039	0.038	0.037
10	0.037	0.036	0.035	0.038	0.037	0.036
11	0.036	0.035	0.034	0.036	0.035	0.035
12	0.034	0.033	0.033	0.035	0.034	0.033

TABLE 10-5(5)
2 x 6 Single Wood Stud: R-21 Batt

NOTE:
Nominal Batt R-value:
R-21 at 5.5 inch thickness

Installed Batt R-value:
R-21 in 5.5 inch cavity

Siding Material/Framing Type						
	Lapped Wood			T1-11		
R-value of Foam Board	STD	INT	ADV	STD	INT	ADV
0	0.057	0.054	0.051	0.060	0.056	0.053
1	0.054	0.051	0.048	0.056	0.053	0.050
2	0.050	0.048	0.045	0.052	0.050	0.047
3	0.048	0.045	0.043	0.049	0.047	0.045
4	0.045	0.043	0.041	0.047	0.045	0.043
5	0.043	0.041	0.040	0.044	0.042	0.041
6	0.041	0.039	0.038	0.042	0.041	0.039
7	0.039	0.038	0.036	0.040	0.039	0.037
8	0.038	0.036	0.035	0.039	0.037	0.036
9	0.036	0.035	0.034	0.037	0.036	0.035
10	0.035	0.034	0.033	0.036	0.035	0.033
11	0.033	0.033	0.032	0.034	0.033	0.032
12	0.032	0.031	0.031	0.033	0.032	0.031

TABLE 10-5(6)
2 x 6 Single Wood Stud: R-22 Batt

NOTE:
Nominal Batt R-value:
R-22 at 6.75 inch thickness

Installed Batt R-value:
R-20 in 5.5 inch cavity

Siding Material/Framing Type						
	Lapped Wood			T1-11		
R-value of Foam Board	STD	INT	ADV	STD	INT	ADV
0	0.059	0.055	0.052	0.062	0.058	0.054
1	0.055	0.052	0.049	0.057	0.054	0.051
2	0.052	0.049	0.047	0.054	0.051	0.048
3	0.049	0.046	0.044	0.050	0.048	0.046
4	0.046	0.044	0.042	0.048	0.046	0.044
5	0.044	0.042	0.041	0.045	0.043	0.042
6	0.042	0.040	0.039	0.043	0.042	0.040
7	0.040	0.039	0.037	0.041	0.040	0.038
8	0.038	0.037	0.036	0.039	0.038	0.037
9	0.037	0.036	0.035	0.038	0.037	0.035
10	0.035	0.034	0.033	0.036	0.035	0.034
11	0.034	0.033	0.032	0.035	0.034	0.033
12	0.033	0.032	0.031	0.034	0.033	0.032

TABLE 10-5(7)
2 x 6 Single Wood Stud: Two R-11 Batts

NOTE:
Nominal Batt R-value:
R-22 at 7 inch thickness

Installed Batt R-value:
R-18.9 in 5.5 inch cavity

Siding Material/Framing Type						
	Lapped Wood			T1-11		
R-value of Foam Board	STD	INT	ADV	STD	INT	ADV
0	0.060	0.057	0.054	0.063	0.059	0.056
1	0.056	0.053	0.051	0.059	0.056	0.053
2	0.053	0.050	0.048	0.055	0.052	0.050
3	0.050	0.048	0.046	0.052	0.049	0.047
4	0.047	0.045	0.044	0.049	0.047	0.045
5	0.045	0.043	0.042	0.046	0.045	0.043
6	0.043	0.041	0.040	0.044	0.043	0.041
7	0.041	0.040	0.038	0.042	0.041	0.039
8	0.039	0.038	0.037	0.040	0.039	0.038
9	0.038	0.037	0.036	0.039	0.038	0.036
10	0.036	0.035	0.034	0.037	0.036	0.035
11	0.035	0.034	0.033	0.036	0.035	0.034
12	0.034	0.033	0.032	0.034	0.034	0.033

TABLE 10-5(8)
2 x 8 Single Stud: R-25 Batt

NOTE:
Nominal Batt R-value:
R-25 at 8 inch thickness

Installed Batt R-value:
R-23.6 in 7.25 inch cavity

Siding Material/Framing Type						
	Lapped Wood			T1-11		
R-value of Foam Board	STD	INT	ADV	STD	INT	ADV
0	0.051	0.047	0.045	0.053	0.049	0.046
1	0.048	0.045	0.043	0.049	0.046	0.044
2	0.045	0.043	0.041	0.047	0.044	0.042
3	0.043	0.041	0.039	0.044	0.042	0.040
4	0.041	0.039	0.037	0.042	0.040	0.038
5	0.039	0.037	0.036	0.040	0.038	0.037
6	0.037	0.036	0.035	0.038	0.037	0.036
7	0.036	0.035	0.033	0.037	0.035	0.034
8	0.035	0.033	0.032	0.035	0.034	0.033
9	0.033	0.032	0.031	0.034	0.033	0.032
10	0.032	0.031	0.030	0.033	0.032	0.031
11	0.031	0.030	0.029	0.032	0.031	0.030
12	0.030	0.029	0.028	0.031	0.030	0.029

TABLE 10-5(9)

2 x 6: Strap Wall

	Siding Material/Frame Type			
	Lapped Wood		T1-11	
	STD	ADV	STD	ADV
R-19 + R-11 Batts	0.036	0.035	0.038	0.036
R-19 + R-8 Batts	0.041	0.039	0.042	0.040

TABLE 10-5(10)

2 x 6 + 2 x 4: Double Wood Stud

Batt Configuration			Siding Material/Frame Type			
			Lapped Wood		T1-11	
Exterior	Middle	Interior	STD	ADV	STD	ADV
R-19	--	R-11	0.040	0.037	0.041	0.038
R-19	--	R-19	0.034	0.031	0.035	0.032
R-19	R-8	R-11	0.029	0.028	0.031	0.029
R-19	R-11	R-11	0.027	0.026	0.028	0.027
R-19	R-11	R-19	0.024	0.023	0.025	0.023
R-19	R-19	R-19	0.021	0.020	0.021	0.020

TABLE 10-5(11)

2 x 4 + 2 x 4: Double Wood Stud

Batt Configuration			Siding Material/Frame Type			
			Lapped Wood		T1-11	
Exterior	Middle	Interior	STD	ADV	STD	ADV
R-11	--	R-11	0.050	0.046	0.052	0.048
R-19	--	R-11	0.039	0.037	0.043	0.039
R-11	R-8	R-11	0.037	0.035	0.036	0.036
R-11	R-11	R-11	0.032	0.031	0.033	0.032
R-13	R-13	R-13	0.029	0.028	0.029	0.028
R-11	R-19	R-11	0.026	0.026	0.027	0.026

TABLE 10-5(12)

Log Walls

	Average Log Diameter, Inches	U-factor
NOTE:		
R-value of wood:	6	0.148
R-1.25 per inch thickness	8	0.111

	10	0.089
Average wall thickness	12	0.074
90% average log diameter	14	0.063
	16	0.056

TABLE 10-5(13)
Stress Skin Panel

Panel Thickness, Inches	U-factor
3 1/2	0.071
5 1/2	0.048
7 1/4	0.037
9 1/4	0.030
11 1/4	0.025

NOTE:
R-value of expanded polystyrene: R-3.85 per inch

Framing: 6%
Spline: 8%
No thermal bridging between interior and exterior splines

Metal Stud Walls: The nominal R-values in Table 10-5A may be used for purposes of calculating metal stud wall section U-factors in lieu of the ASHRAE zone calculation method as provided in Chapter 25 of Standard RS-1.

TABLE 10-5A
DEFAULT U-FACTORS FOR OVERALL ASSEMBLY METAL STUD WALLS, EFFECTIVE R-VALUES FOR METAL FRAMING AND CAVITY ONLY, AND DEFAULT METAL BUILDING U-FACTORS

TABLE 10-5A(1)
OVERALL ASSEMBLY U-FACTORS FOR METAL STUD WALLS

Metal Framing	R-Value of Continuous Foam Board Insulation	Cavity Insulation					
		R-0	R-11	R-13	R-15	R-19	R-21
16" o.c.	R-0 (none)	U-0.352	U-0.132	U-0.124	U-0.118	U-0.109	U-0.106
	R-1	U-0.260	U-0.117	U-0.111	U-0.106	U-0.099	U-0.096
	R-2	U-0.207	U-0.105	U-0.100	U-0.096	U-0.090	U-0.087
	R-3	U-0.171	U-0.095	U-0.091	U-0.087	U-0.082	U-0.080
	R-4	U-0.146	U-0.087	U-0.083	U-0.080	U-0.076	U-0.074
	R-5	U-0.128	U-0.080	U-0.077	U-0.074	U-0.071	U-0.069
	R-6	U-0.113	U-0.074	U-0.071	U-0.069	U-0.066	U-0.065
	R-7	U-0.102	U-0.069	U-0.066	U-0.065	U-0.062	U-0.061
	R-8	U-0.092	U-0.064	U-0.062	U-0.061	U-0.058	U-0.057
	R-9	U-0.084	U-0.060	U-0.059	U-0.057	U-0.055	U-0.054
	R-10	U-0.078	U-0.057	U-0.055	U-0.054	U-0.052	U-0.051
24" o.c.	R-0 (none)	U-0.338	U-0.116	U-0.108	U-0.102	U-0.094	U-0.090

R-1	U-0.253	U-0.104	U-0.098	U-0.092	U-0.086	U-0.083
R-2	U-0.202	U-0.094	U-0.089	U-0.084	U-0.079	U-0.077
R-3	U-0.168	U-0.086	U-0.082	U-0.078	U-0.073	U-0.071
R-4	U-0.144	U-0.079	U-0.075	U-0.072	U-0.068	U-0.066
R-5	U-0.126	U-0.073	U-0.070	U-0.067	U-0.064	U-0.062
R-6	U-0.112	U-0.068	U-0.066	U-0.063	U-0.060	U-0.059
R-7	U-0.100	U-0.064	U-0.062	U-0.059	U-0.057	U-0.055
R-8	U-0.091	U-0.060	U-0.058	U-0.056	U-0.054	U-0.052
R-9	U-0.084	U-0.057	U-0.055	U-0.053	U-0.051	U-0.050
R-10	U-0.077	U-0.054	U-0.052	U-0.050	U-0.048	U-0.048

TABLE 10-5A(2)
EFFECTIVE R-VALUES FOR METAL FRAMING AND CAVITY ONLY

	Cavity		Insulation		
	Nominal Depth, Inches	Actual Depth, Inches	Nominal R-Value	Effective R-Value 16" O.C.	Effective R-Value 24" O.C.
Air Cavity	Any	Any	R-0.91 (air)	0.79	0.91
Wall	4	3-1/2	R-11	5.5	6.6
	4	3-1/2	R-13	6.0	7.2
	4	3-1/2	R-15	6.4	7.8
	6	5-1/2	R-19	7.1	8.6
	6	5-1/2	R-21	7.4	9.0
	8	7-1/4	R-25	7.8	9.6
Roof		Insulation is uncompressed	R-11	5.5	6.1
			R-19	7.0	9.1
			R-30	9.3	11.4

TABLE 10-5A(3)
Default Metal Building Wall U-Factors

Insulation System	Nominal R-Value of Insulation	Total Nominal R-Value of Insulation	Overall U-Factor for Entire Base Wall Assembly	Overall U-Factor for Assembly of Base Wall Plus Continuous Insulation (uninterrupted by framing) Nominal R-Value of Continuous Insulation					
				R-5.6	R-11.2	R-16.8	R-22.4	R-28.0	R-33.6
Single Layer of Mineral Fiber									
None	0		**1.180**	0.161	0.086	0.059	0.045	0.036	0.030
R-6	6		**0.184**	0.091	0.060	0.045	0.036	0.030	0.026
R-10	10		**0.134**	0.077	0.054	0.051	0.033	0.028	0.024
R-11	11		**0.123**	0.073	0.052	0.040	0.033	0.028	0.024
R-13	13		**0.113**	0.069	0.050	0.039	0.032	0.027	0.024
Double Layer of Mineral Fiber				N/A	N/A	N/A	N/A	N/A	N/A
(Second layer inside of girts)				N/A	N/A	N/A	N/A	N/A	N/A
(Multiple layers are listed in order from inside to outside)				N/A	N/A	N/A	N/A	N/A	N/A
				N/A	N/A	N/A	N/A	N/A	N/A

R-6 + R-13	19	**0.070**
R-10 + R-13	23	**0.061**
R-13 + R-13	26	**0.057**
R-19 + R-13	32	**0.048**

((

	~~R-10~~	~~R-11~~	~~R-13~~	~~R-19~~	~~R-24~~	~~R-30~~
~~Faced fiber glass blanket insulation rolled over and perpendicular to structural frame. Metal covering sheets fastened to the frame, holding insulation in place.~~	~~0.133~~	~~0.127~~	~~0.114~~	~~0.091~~	~~na~~	~~Na~~
~~Faced fiber glass batt insulation suspended between structural frame. Metal covering sheets fastened directly to frame.~~	~~0.131~~	~~0.123~~	~~0.107~~	~~0.079~~	~~0.065~~	~~0.057~~
~~Faced fiber glass blanket insulation rolled over and perpendicular to structural frame. Rigid insulation blocks placed over insulation to align with structural frame.~~	~~0.102~~	~~0.096~~	~~0.084~~	~~0.065~~	~~na~~	~~Na~~
~~Faced fiber glass batt insulation suspended between structural frame. Rigid insulation blocks placed over insulation to align with structural frame.~~	~~0.099~~	~~0.093~~	~~0.080~~	~~0.059~~	~~0.048~~	~~0.041~~

))

Concrete Masonry Walls: The nominal R-values in Table 10-5B may be used for purposes of calculating concrete masonry wall section U-factors in lieu of the ASHRAE isothermal planes calculation method as provided in Chapter 25 of Standard RS-1.

TABLE 10-5B(1)
GROUP R OCCUPANCY: DEFAULT U-FACTORS FOR CONCRETE AND MASONRY WALLS

TABLE 10-5B(1a): Group R Occupancy
8" Concrete Masonry

WALL DESCRIPTION	*CORE TREATMENT*			
	Partial Grout with Ungrouted Cores			Solid Grout
	Empty	Loose-fill insulated		
		Perlite	Vermiculite	
Exposed Block, Both Sides	0.40	0.23	0.24	0.43
R-5 Interior Insulation, Wood Furring	0.14	0.11	0.12	0.15
R-6 Interior Insulation, Wood Furring	0.14	0.11	0.11	0.14
R-10.5 Interior Insulation, Wood Furring	0.11	0.09	0.09	0.11
R-8 Interior Insulation, Metal Clips	0.11	0.09	0.09	0.11
R-6 Exterior Insulation	0.12	0.10	0.10	0.12
R-10 Exterior Insulation	0.08	0.07	0.07	0.08
R-9.5 Rigid Polystyrene Integral Insulation, Two Webbed Block	0.11	0.09	0.09	0.12

TABLE 10-5B(1b): Group R Occupancy
12" Concrete Masonry

WALL DESCRIPTION	*CORE TREATMENT*			
	Partial Grout with Ungrouted Cores			Solid Grout
	Empty	Loose-fill insulated		
		Perlite	Vermiculite	
Exposed Block, Both Sides	0.35	0.17	0.18	0.33
R-5 Interior Insulation, Wood Furring	0.14	0.10	0.10	0.13
R-6 Interior Insulation, Wood Furring	0.13	0.09	0.10	0.13
R-10.5 Interior Insulation, Wood Furring	0.11	0.08	0.08	0.10
R-8 Interior Insulation, Metal Clips	0.10	0.08	0.08	0.09
R-6 Exterior Insulation	0.11	0.09	0.09	0.11
R-10 Exterior Insulation	0.08	0.06	0.06	0.08
R-9.5 Rigid Polystyrene Integral Insulation, Two Webbed Block	0.11	0.08	0.09	0.12

TABLE 10-5B(1c): Group R Occupancy
8" Clay Brick

WALL DESCRIPTION	*CORE TREATMENT*			
	Partial Grout with Ungrouted Cores			Solid Grout
	Empty	Loose-fill insulated		
		Perlite	Vermiculite	
Exposed Block, Both Sides	0.50	0.31	0.32	0.56
R-5 Interior Insulation, Wood Furring	0.15	0.13	0.13	0.16
R-6 Interior Insulation, Wood Furring	0.15	0.12	0.12	0.15
R-10.5 Interior Insulation, Wood Furring	0.12	0.10	0.10	0.12
R-8 Interior Insulation, Metal Clips	0.11	0.10	0.10	0.11
R-6 Exterior Insulation	0.12	0.11	0.11	0.13
R-10 Exterior Insulation	0.08	0.08	0.08	0.09

TABLE 10-5B(1d): Group R Occupancy
6" Concrete Poured or Precast

WALL DESCRIPTION	*CORE TREATMENT*			
	Partial Grout with Ungrouted Cores			Solid Grout
	Empty	Loose-fill insulated		
		Perlite	Vermiculite	
Exposed Concrete, Both Sides	NA	NA	NA	0.61
R-5 Interior Insulation, Wood Furring	NA	NA	NA	0.16
R-6 Interior Insulation, Wood Furring	NA	NA	NA	0.15
R-10.5 Interior Insulation, Wood Furring	NA	NA	NA	0.12
R-8 Interior Insulation, Metal Clips	NA	NA	NA	0.12

R-6 Exterior Insulation	NA	NA	NA	0.13
R-10 Exterior Insulation	NA	NA	NA	0.09

TABLE 10-5B(1e): Group R Occupancy and Other than Group R Occupancy
Peripheral Edges of Intermediate Concrete Floors

Slab Edge Treatment	Average Thickness of Wall Above and Below			
	6 inches	8 inches	10 inches	12 inches
Exposed Concrete	0.816	0.741	0.678	0.625
R-5 Exterior Insulation	0.161	0.157	0.154	0.152
R-6 Exterior Insulation	0.138	0.136	0.134	0.132
R-7 Exterior Insulation	0.122	0.120	0.118	0.116
R-8 Exterior Insulation	0.108	0.107	0.106	0.104
R-9 Exterior Insulation	0.098	0.097	0.095	0.094
R-10 Exterior Insulation	0.089	0.088	0.087	0.086
R-11 Exterior Insulation	0.082	0.081	0.080	0.079
R-12 Exterior Insulation	0.076	0.075	0.074	0.074
R-13 Exterior Insulation	0.070	0.070	0.069	0.068
R-14 Exterior Insulation	0.066	0.065	0.065	0.064
R-15 Exterior Insulation	0.062	0.061	0.061	0.060

Notes for Default Table 10-5B(1)

1. Grouted cores at 40" x 48" on center vertically and horizontally in partial grouted walls.
2. Interior insulation values include 1/2" gypsum board on the inner surface.
3. Furring and stud spacing is 16" on center. Insulation is assumed to fill furring space and is not compressed.
4. Intermediate values may be interpolated using this table. Values not contained in this table may be computed using the procedures listed in Standard RS-1.

TABLE 10-5B(2)
OTHER THAN GROUP R OCCUPANCY:
DEFAULT U-FACTORS FOR CONCRETE AND MASONRY WALLS

Framing Type and Depth	Rated R-Value of Insulation Alone	Assembly U-Factors for Solid Concrete Walls	Assembly U-Factors for Concrete Block Walls: Solid Grouted	Assembly U-Factors for Concrete Block Walls: Partially Grouted (Cores uninsulated except where specified)
No Framing	R- 0	U- 0.740	U- 0.580	U- 0.480
	Ungrouted Cores Filled with Loose-Fill Insulation	N.A.	N.A.	U- 0.350
Continuous Wood Framing				
0.75 in.	R- 3.0	U- 0.247	U- 0.226	U- 0.210
1.5 in.	R- 6.0	U- 0.160	U- 0.151	U- 0.143
2.0 in.	R- 10.0	U- 0.116	U- 0.111	U- 0.107
3.5 in.	R- 11.0	U- 0.094	U- 0.091	U- 0.088
3.5 in.	R- 13.0	U- 0.085	U- 0.083	U- 0.080
3.5 in.	R- 15.0	U- 0.079	U- 0.077	U- 0.075
5.5 in.	R- 19.0	U- 0.060	U- 0.059	U- 0.058

5.5 in.	R- 21.0	U- 0.057	U- 0.055	U- 0.054
Continuous Metal Framing at 24 in. on center horizontally				
0.75 in.	R- 3.0	U- 0.364	U- 0.321	U- 0.288
1.5 in.	R- 6.0	U- 0.274	U- 0.249	U- 0.229
2.0 in.	R- 10.0	U- 0.225	U- 0.207	U- 0.193
3.5-4.0 in.	R- 11.0	U- 0.168	U- 0.158	U- 0.149
3.5-4.0 in.	R- 13.0	U- 0.161	U- 0.152	U- 0.144
3.5-4.0 in.	R- 15.0	U- 0.155	U- 0.147	U- 0.140
5.5-6.0 in.	R- 19.0	U- 0.118	U- 0.113	U- 0.109
5.5-6.0 in.	R- 21.0	U- 0.113	U- 0.109	U- 0.105
1 in. Metal Clips at 24 in. on center horizontally and 16 in. vertically				
1.0 in.	R- 3.8	U- 0.210	U- 0.195	U- 0.182
1.0 in.	R- 5.0	U- 0.184	U- 0.172	U- 0.162
1.0 in.	R- 5.6	U- 0.174	U- 0.163	U- 0.154
1.5 in.	R- 5.7	U- 0.160	U- 0.151	U- 0.143
1.5 in.	R- 7.5	U- 0.138	U- 0.131	U- 0.125
1.5 in.	R- 8.4	U- 0.129	U- 0.123	U- 0.118
2.0 in.	R- 7.6	U- 0.129	U- 0.123	U- 0.118
2.0 in.	R- 10.0	U- 0.110	U- 0.106	U- 0.102
2.0 in.	R- 11.2	U- 0.103	U- 0.099	U- 0.096
2.5 in.	R- 9.5	U- 0.109	U- 0.104	U- 0.101
2.5 in.	R- 12.5	U- 0.092	U- 0.089	U- 0.086
2.5 in.	R- 14.0	U- 0.086	U- 0.083	U- 0.080
3.0 in.	R- 11.4	U- 0.094	U- 0.090	U- 0.088
3.0 in.	R- 15.0	U- 0.078	U- 0.076	U- 0.074
3.0 in.	R- 16.8	U- 0.073	U- 0.071	U- 0.069
3.5 in.	R- 13.3	U- 0.082	U- 0.080	U- 0.077
3.5 in.	R- 17.5	U- 0.069	U- 0.067	U- 0.065
3.5 in.	R- 19.6	U- 0.064	U- 0.062	U- 0.061
4.0 in.	R- 15.2	U- 0.073	U- 0.071	U- 0.070
4.0 in.	R- 20.0	U- 0.061	U- 0.060	U- 0.058
4.0 in.	R- 22.4	U- 0.057	U- 0.056	U- 0.054
5.0 in.	R- 28.0	U- 0.046	U- 0.046	U- 0.045
Continuous Insulation Uninterrupted by Framing				
No Framing	R- 3.0	U- 0.230	U- 0.212	U- 0.197
	R- 4.0	U- 0.187	U- 0.175	U- 0.164
	R- 5.0	U- 0.157	U- 0.149	U- 0.141
No Framing	R- 6.0	U- 0.136	U- 0.129	U- 0.124
	R- 7.0	U- 0.120	U- 0.115	U- 0.110
	R- 8.0	U- 0.107	U- 0.103	U- 0.099
	R- 9.0	U- 0.097	U- 0.093	U- 0.090
	R- 10.0	U- 0.088	U- 0.085	U- 0.083
No Framing	R- 11.0	U- 0.081	U- 0.079	U- 0.076
	R- 12.0	U- 0.075	U- 0.073	U- 0.071
	R- 13.0	U- 0.070	U- 0.068	U- 0.066
	R- 14.0	U- 0.065	U- 0.064	U- 0.062
	R- 15.0	U- 0.061	U- 0.060	U- 0.059
No Framing	R- 16.0	U- 0.058	U- 0.056	U- 0.055
	R- 17.0	U- 0.054	U- 0.053	U- 0.052
	R- 18.0	U- 0.052	U- 0.051	U- 0.050
	R- 19.0	U- 0.049	U- 0.048	U- 0.047
	R- 20.0	U- 0.047	U- 0.046	U- 0.045

Notes for Default Table 10-5B(2)

1. It is acceptable to use the U-factors in Table 10-5B(2) for all concrete and masonry walls, provided that the grouting is equal to or less than that specified.
   – For ungrouted walls, use the partially-grouted column.
   – For metal studs and z-furring, use the continuous-metal-framing category.
   – For discontinuous metal clips 1 inch square or smaller, use the metal-clip category.
   – For insulation that is attached without any framing members (e.g. glued), use the continuous-insulation-uninterrupted-by-framing category. Continuous insulation may be installed on the interior or exterior of masonry walls, or between stand-alone walls in multi-layer masonry walls, or on the interior or exterior of the concrete.

2. For Table 10-5B(2), the U-factor includes R-0.17 for exterior air film and R-0.68 for interior air film - vertical surfaces. For insulated walls, the U-factor also includes R-0.45 for 0.5 in. gypsum board. U-factors are provided for the following configurations:
   (a) Concrete wall: 8-in. normal weight concrete wall with a density of 145 lb/ft^3.
   (b) Solid grouted concrete block wall: 8-in. medium weight ASTM C90 concrete block with a density of 115 lb/ft^3 and solid grouted cores.
   (c) Partially grouted concrete block wall: 8-in. medium weight ASTM C90 concrete block with a density of 115 lb/ft^3 having reinforcing steel every 32 in. vertically and every 48 in. horizontally, with cores grouted in those areas only. Other cores are filled with insulating material only if there is no other insulation.

3. For walls with insulation contained in a framing layer, the U-factors in Table 10-5B(2) assume contact (and thermal bridging) between the mass wall and other framing. For wall assemblies with multiple layers where the wood or metal framing layer does not contact the concrete or masonry layer (i.e. walls with an airspace between the stud wall layer and the mass wall layer), it is acceptable to use the appropriate wood or metal frame wall default U-factors in Tables 10-5 or 10-5A. Note, it is acceptable to use this approach where the insulation extends beyond the framing and is in contact with the mass wall layer (e.g. a nominal four-inch metal stud containing insulation that is nominally six inches thick and therefore extends two inches beyond the back of the metal stud).

4. Except for wall assemblies qualifying for note 3, if not taken from Table 10-5B(2), mass wall U-factors shall be determined in accordance with ASHRAE/IESNA Standard 90.1-2004, Appendix A, Section A3.1 and Tables A3.1A to A3.1D, or Section A9.4. If not taken from Table 10-9, heat capacity for mass walls shall be taken from ASHRAE/IESNA Standard 90.1-2004, Appendix A, Table A3.1B or A3.1C.

1007 Ceilings.

Discussion: (1) Provide individual table numbering for ease of reference;
(2) Add table with default U-factors for metal building roofs from ASHRAE/IESNA Standard 90.1-2004, addendum al; and
(3) Add table with default U-factors for roofs with insulation entirely above deck from ASHRAE/IESNA Standard 90.1-2004, Table A2.2, and additional listings for equivalent area-weighted insulation R-values for sloped insulation.

Proposal: Amend 2006 WSEC as follows -

SECTION 1007 -- CEILINGS

1007.1 General: Table 10-7 lists heat loss coefficients for the opaque portion of exterior ceilings below vented attics, vaulted ceilings and roof decks in units of Btu/h•ft^2•°F of ceiling.

They are derived from procedures listed in Standard RS-1, listed in Chapter 7. Ceiling U-factors are modified for the buffering effect of the attic, assuming an indoor temperature of 65°F and an outdoor temperature of 45°F.

Metal Framed Ceilings: The nominal R-values in Table 10-5A(2): Effective R-Values for Metal Framing and Cavity Only may be used for purposes of calculating metal framed ceiling section U-factors in lieu of the ASHRAE zone calculation method as provided in Chapter 25 of Standard RS-1.

Metal building roofs have a different construction and are addressed in Table 10-7(F).

1007.2 Component Description: The ((~~four~~)) types of ceilings are characterized as follows:

Ceilings Below a Vented Attic: Attic insulation is assumed to be blown-in, loose-fill fiberglass with a K-value of 2.6 h•ft^2•°F/Btu per inch. Full bag count for specified R-value is assumed in all cases. Ceiling dimensions for flat ceiling calculations are 45 by 30 feet, with a gabled roof having a 4/12 pitch. The attic is assumed to vent naturally at the rate of 3 air changes per hour through soffit and ridge vents. A void fraction of 0.002 is assumed for all attics with insulation baffles. Standard-framed, unbaffled attics assume a void fraction of 0.008.

Attic framing is either standard or advanced. Standard framing assumes tapering of insulation depth around the perimeter with resultant decrease in thermal resistance. An increased R-value is assumed in the center of the ceiling due to the effect of piling leftover insulation. Advanced framing assumes full and even depth of insulation extending to the outside edge of exterior walls. Advanced framing does not change from the default value.

U-factors for flat ceilings below vented attics with standard framing may be modified with the following table:

Roof Pitch	U-factor for Standard Framing	
	R-30	R-38
4/12	0.036	0.031
5/12	0.035	0.030
6/12	0.034	0.029
7/12	0.034	0.029
8/12	0.034	0.028
9/12	0.034	0.028
10/12	0.033	0.028
11/12	0.033	0.027
12/12	0.033	0.027

Vented scissors truss attics assume a ceiling pitch of 2/12 with a roof pitch of either 4/12 or 5/12. Unbaffled standard framed scissors truss attics are assumed to have a void fraction of 0.016.

Vaulted Ceilings: Insulation is assumed to be fiberglass batts installed in roof joist cavities. In the vented case, at least 1.5 inches between the top of the batts and the underside of the roof sheathing is left open for ventilation in each cavity. A ventilation rate of 3.0 air changes per hour is assumed. In the unvented or dense pack case, the ceiling cavity is assumed to be fully packed with insulation, leaving no space for ventilation.

Roof Decks: Rigid insulation is applied to the top of roof decking with no space left for ventilation. Roofing materials are attached directly on top of the insulation. Framing members are often left exposed on the interior side.

Metal Truss Framing: Overall system tested values for the roof/ceiling U_o for metal framed truss assemblies from approved laboratories shall be used, when such data is acceptable to the building official.

Alternatively, the U_o for roof/ceiling assemblies using metal truss framing may be obtained from Tables 10-7A, 10-7B, 10-7C, 10-7D, and 10-7E.

Steel Truss Framed Ceiling, Table 10-7A.

Steel Truss Framed Ceiling with R-3 Sheathing, Table 10-7B.

Steel Truss Framed Ceiling with R-5 Sheathing, Table 10-7C.

Steel Truss Framed Ceiling with R-10 Sheathing, Table 10-7D.

Steel Truss Framed Ceiling with R-15 Sheathing, Table 10-7E.

Metal Building Roof, Table 10-7F: the base assembly is a roof where the insulation is draped over the steel structure (purlins) and then compressed when the metal roof panels are attached to the steel structure (purlins). Additional assemblies include continuous insulation, uncompressed and uninterrupted by framing.

The first nominal R-value is for insulation draped over purlins and then compressed when the metal roof panels are attached, or for insulation hung between the purlins. A minimum 1 in. R-5 thermal spacer block between the purlins and the metal roof panels is required when specified in Table 10-7F.

For double-layer installations, the second nominal R-value is for insulation installed parallel to the purlins.

For continuous insulation (e.g., insulation boards or blankets), it is assumed that the insulation is installed below the purlins and is uninterrupted by framing members. Insulation exposed to the conditioned space or semiheated space shall have a facing, and all insulation seams shall be continuously sealed to provide a continuous air barrier.

Roofs with Insulation Entirely Above Deck (uninterrupted by framing), Table 10-7G: the base assembly is continuous insulation over a structural deck. Added insulation is continuous and uninterrupted by framing. For the insulation, the first column lists the R-value for continuous insulation with a uniform thickness; the second column lists the comparable area-weighted average R-value for continuous insulation provided that the insulation thickness is never less than R-5 (except at roof drains) and that the slope is no greater than ¼ inch per foot.

TABLE 10-7
DEFAULT U-FACTORS FOR CEILINGS

	Standard Frame	Advanced Frame
Ceilings Below Vented Attics		
Flat	**Baffled**	
R-19	0.049	0.047
R-30	0.036	0.032
R-38	0.031	0.026
R-49	0.027	0.020
R-60	0.025	0.017
Scissors Truss		
R-30 (4/12 roof pitch)	0.043	0.031
R-38 (4/12 roof pitch)	0.040	0.025

R-49 (4/12 roof pitch)	0.038	0.020
R-30 (5/12 roof pitch)	0.039	0.032
R-38 (5/12 roof pitch)	0.035	0.026
R-49 (5/12 roof pitch)	0.032	0.020
Vaulted Ceilings	**16" O.C.**	**24" O.C.**
Vented		
R-19 2x10 joist	0.049	0.048
R-30 2x12 joist	0.034	0.033
R-38 2x14 joist	0.027	0.027
Unvented		
R-30 2x10 joist	0.034	0.033
R-38 2x12 joist	0.029	0.027
R-21 + R-21 2x12 joist	0.026	0.025
Roof Deck	**4x Beams, 48" O.C.**	
R-12.5 2" Rigid insulation	0.064	
R-21.9 3.5" Rigid insulation	0.040	
R-37.5 6" Rigid insulation	0.025	
R-50 8" Rigid insulation	0.019	

TABLE 10-7A
Steel Truss[1] Framed Ceiling U_o

Cavity R-value	Truss Span (ft)												
	12	14	16	18	20	22	24	26	28	30	32	34	36
19	0.1075	0.0991	0.0928	0.0878	0.0839	0.0807	0.0780	0.0757	0.0737	0.0720	0.0706	0.0693	0.0681
30	0.0907	0.0823	0.0760	0.0710	0.0671	0.0638	0.0612	0.0589	0.0569	0.0552	0.0538	0.0525	0.0513
38	0.0844	0.0759	0.0696	0.0647	0.0607	0.0575	0.0548	0.0525	0.0506	0.0489	0.0474	0.0461	0.0449
49	0.0789	0.0704	0.0641	0.0592	0.0552	0.0520	0.0493	0.0470	0.0451	0.0434	0.0419	0.0406	0.0395

TABLE 10-7B
Steel Truss[1] Framed Ceiling U_o with R-3 Sheathing

Cavity R-value	Truss Span (ft)												
	12	14	16	18	20	22	24	26	28	30	32	34	36
19	0.0809	0.0763	0.0728	0.0701	0.0679	0.0661	0.0647	0.0634	0.0623	0.0614	0.0606	0.0599	0.0592
30	0.0641	0.0595	0.0560	0.0533	0.0511	0.0493	0.0478	0.0466	0.0455	0.0446	0.0438	0.0431	0.0424
38	0.0577	0.0531	0.0496	0.0469	0.0447	0.0430	0.0415	0.0402	0.0392	0.0382	0.0374	0.0367	0.0361
49	0.0523	0.0476	0.0441	0.0414	0.0393	0.0375	0.0360	0.0348	0.0337	0.0328	0.0319	0.0312	0.0306

TABLE 10-7C
Steel Truss[1] Framed Ceiling U_o with R-5 Sheathing

Cavity R-value	Truss Span (ft)												
	12	14	16	18	20	22	24	26	28	30	32	34	36
19	0.0732	0.0697	0.0670	0.0649	0.0633	0.0619	0.0608	0.0598	0.0590	0.0583	0.0577	0.0571	0.0567
30	0.0564	0.0529	0.0502	0.0481	0.0465	0.0451	0.0440	0.0430	0.0422	0.0415	0.0409	0.0403	0.0399
38	0.0501	0.0465	0.0438	0.0418	0.0401	0.0388	0.0376	0.0367	0.0359	0.0351	0.0345	0.0340	0.0335
49	0.0446	0.0410	0.0384	0.0363	0.0346	0.0333	0.0322	0.0312	0.0304	0.0297	0.0291	0.0285	0.0280

TABLE 10-7D
Steel Truss[1] Framed Ceiling U_o with R-10 Sheathing

Cavity R-value	Truss Span (ft)												
	12	14	16	18	20	22	24	26	28	30	32	34	36
19	0.0626	0.0606	0.0590	0.0578	0.0569	0.0561	0.0555	0.0549	0.0545	0.0541	0.0537	0.0534	0.0531
30	0.0458	0.0437	0.0422	0.0410	0.0401	0.0393	0.0387	0.0381	0.0377	0.0373	0.0369	0.0366	0.0363
38	0.0394	0.0374	0.0359	0.0347	0.0337	0.0330	0.0323	0.0318	0.0313	0.0309	0.0305	0.0302	0.0299
49	0.0339	0.0319	0.0304	0.0292	0.0283	0.0275	0.0268	0.0263	0.0258	0.0254	0.0251	0.0247	0.0245

TABLE 10-7E
Steel Truss[1] Framed Ceiling U_o with R-15 Sheathing

Cavity R-value	Truss Span (ft)												
	12	14	16	18	20	22	24	26	28	30	32	34	36
19	0.0561	0.0550	0.0541	0.0535	0.0530	0.0526	0.0522	0.0519	0.0517	0.0515	0.0513	0.0511	0.0509
30	0.0393	0.0382	0.0373	0.0367	0.0362	0.0358	0.0354	0.0351	0.0349	0.0347	0.0345	0.0343	0.0341
38	0.0329	0.0318	0.0310	0.0303	0.0298	0.0294	0.0291	0.0288	0.0285	0.0283	0.0281	0.0279	0.0278
49	0.0274	0.0263	0.0255	0.0249	0.0244	0.0239	0.0236	0.0233	0.0230	0.0228	0.0226	0.0225	0.0223

1. Assembly values based on 24 inch on center truss spacing; 11 Truss member connections penetrating insulation (4 at the eaves, 7 in the interior space); ½ inch drywall ceiling; all truss members are 2x4 "C" channels with a solid web.
2. Ceiling sheathing installed between bottom chord and drywall.

TABLE 10-7F
Default Metal Building Roof U-Factors

Insulation System	Nominal R-Value of Insulation	Total Nominal R-Value of Insulation	Overall U-Factor for Entire Base Roof Assembly	Overall U-Factor for Assembly of Base Roof Plus Continuous Insulation (uninterrupted by framing) Nominal R-Value of Continuous Insulation					
				R-5.6	R-11.2	R-16.8	R-22.4	R-28.0	R-33.6
Standing Seam Roofs with Thermal Spacer Blocks									
Single Layer									
None	0		**1.280**	0.162	0.087	0.059	0.045	0.036	0.030
R-6	6		**0.167**	0.086	0.058	0.044	0.035	0.029	0.025
R-10	10		**0.097**	0.063	0.046	0.037	0.031	0.026	0.023
R-11	11		**0.092**	0.061	0.045	0.036	0.030	0.026	0.022
R-13	13		**0.083**	0.057	0.043	0.035	0.029	0.025	0.022
R-16	16		**0.072**	0.051	0.040	0.033	0.028	0.024	0.021
R-19	19		**0.065**	0.048	0.038	0.031	0.026	0.023	0.020
Double Layer									
R-10 + R-10	20		**0.063**	0.047	0.037	0.031	0.026	0.023	0.020
R-10 + R-11	21		**0.061**	0.045	0.036	0.030	0.026	0.023	0.020
R-11 + R-11	22		**0.060**	0.045	0.036	0.030	0.026	0.022	0.020
R-10 + R-13	23		**0.058**	0.044	0.035	0.029	0.025	0.022	0.020
R-11 + R-13	24		**0.057**	0.043	0.035	0.029	0.025	0.022	0.020
R-13 + R-13	26		**0.055**	0.042	0.034	0.029	0.025	0.022	0.019
R-10 + R-19	29		**0.052**	0.040	0.033	0.028	0.024	0.021	0.019
R-11 + R-19	30		**0.051**	0.040	0.032	0.027	0.024	0.021	0.019
R-13 + R-19	32		**0.049**	0.038	0.032	0.027	0.023	0.021	0.019
R-16 + R-19	35		**0.047**	0.037	0.031	0.026	0.023	0.020	0.018
R-19 + R-19	38		**0.046**	0.037	0.030	0.026	0.023	0.020	0.018

Thru-Fastened Roofs Without Thermal Spacer Blocks								
R-10	10	**0.153**	N/A	N/A	N/A	N/A	N/A	N/A
R-11	11	**0.139**	N/A	N/A	N/A	N/A	N/A	N/A
R-13	13	**0.130**	N/A	N/A	N/A	N/A	N/A	N/A
R-16	16	**0.109**	N/A	N/A	N/A	N/A	N/A	N/A
R-19	19	**0.098**	N/A	N/A	N/A	N/A	N/A	N/A
Filled Cavity with Thermal Spacer Blocks								
R-19 + R-10	29	**0.041**	0.033	0.028	0.024	0.021	0.020	0.017

TABLE 10-7G Assembly U-Factors for Roofs with Insulation Entirely Above Deck (uninterrupted by framing)

Rated R-Value of Insulation Alone: Minimum Throughout, Unsloped	Rated R-Value of Insulation Alone: Average (R-5 minimum), Sloped (1/4 inch per foot maximum)	Overall U-Factor for Entire Assembly
R-0	Not allowed	U-1.282
R-1	Not allowed	U-0.562
R-2	Not allowed	U-0.360
R-3	Not allowed	U-0.265
R-4	Not allowed	U-0.209
R-5	Not allowed	U-0.173
R-6	R-7	U-0.147
R-7	R-8	U-0.129
R-8	R-9	U-0.114
R-9	R-10	U-0.102
R-10	R-12	U-0.093
R-11	R-13	U-0.085
R-12	R-15	U-0.078
R-13	R-16	U-0.073
R-14	R-18	U-0.068
R-15	R-20	U-0.063
R-16	R-22	U-0.060
R-17	R-23	U-0.056
R-18	R-25	U-0.053
R-19	R-27	U-0.051
R-20	R-29	U-0.048
R-21	R-31	U-0.046
R-22	R-33	U-0.044
R-23	R-35	U-0.042
R-24	R-37	U-0.040
R-25	R-39	U-0.039
R-26	R-41	U-0.037
R-27	R-43	U-0.036

R-28 R-29 R-30	R-46 R-48 R-50	U-0.035 U-0.034 U-0.032
R-35	R-61	U-0.028
R-40	R-73	U-0.025
R-45	R-86	U-0.022
R-50	R-99	U-0.020
R-55	R-112	U-0.018
R-60	R-126	U-0.016

1132.2 Building Mechanical Systems.

Discussion: (a) Clarify application to certain equipment used in computer server rooms;
(b) Require air-handling units located outdoors to comply with economizer requirements;
(c) Apply chiller efficiency improvements to both COP and IPLV.

Proposal: Amend 2006 WSEC as follows -

1132.2 Building Mechanical Systems: Those parts of systems which are altered or replaced shall comply with Chapter 14 of this Code.

All new systems in existing buildings, including packaged unitary equipment and packaged split systems, shall comply with Chapter 14.

Where mechanical cooling is added to a space that was not previously cooled, the mechanical cooling system shall comply with Sections 1413 and either 1423 or 1433.

Exceptions: These exceptions only apply to situations where mechanical cooling is added to a space that was not previously cooled.

1. Water-cooled refrigerant equipment provided with a water economizer meeting the requirements of Section 1413 need not comply with 1423 or 1433. This exception shall not be used for RS-29 analysis.

2. Alternate designs that are not in full compliance with this Code may be approved when the building official determines that existing building or occupancy constraints make full compliance impractical or where full compliance would be economically impractical.

Alterations to existing mechanical cooling systems shall not decrease economizer capacity unless the system complies with Section 1413 and either 1423 or 1433. In addition, for existing mechanical cooling systems that do not comply with Sections 1413 and either 1423 or 1433 including both the individual unit size limits and the total building capacity limits on units without economizer, other alterations shall comply with Table 11-1.

Existing equipment currently in use may be relocated within the same floor or same tenant space if removed and reinstalled within the same permit.

TABLE 11-1:
ECONOMIZER COMPLIANCE OPTIONS FOR MECHANICAL ALTERATIONS

	Option A	Option B (alternate to A)	Option C (alternate to A)	Option D (alternate to A)
Unit Type	**Any alteration with new or replacement equipment**	**Replacement unit of the same type with the same or smaller output capacity**	**Replacement unit of the same type with a larger output capacity**	**New equipment added to existing system or replacement unit of a different type**
1. Packaged Units	Efficiency: min.[1] Economizer: 1433[2]	Efficiency: min.[1] Economizer: 1433[2,3]	Efficiency: min.[1] Economizer: 1433[2,3]	Efficiency: min.[1] Economizer: 1433[2,4]
2. Split Systems	Efficiency: min.[1] Economizer: 1433[2]	Efficiency: + 10/5%[5] Economizer: shall not decrease existing economizer capability	Only for new units < 54,000 Btuh replacing unit installed prior to 1991 (one of two): Efficiency: + 10/5%[5] Economizer: 50%[6]	Efficiency: min.[1] Economizer: 1433[2,4]

	Option A	**Option B (alternate to A)**	**Option C (alternate to A)**	**Option D (alternate to A)**
Unit Type	**Any alteration with new or replacement equipment**	**Replacement unit of the same type with the same or smaller output capacity**	**Replacement unit of the same type with a larger output capacity**	**New equipment added to existing system or replacement unit of a different type**
			For units > 54,000 Btuh or any units installed after 1991: Option A	
2a. ASHRAE Std 127 equipment	Efficiency: none[1] Economizer: 1433[2]	Efficiency: none[1] Economizer: 1433[2]	Efficiency: none[1] Economizer: 1433[2]	Efficiency: none[1] Economizer: 1433[2]
3. Water Source Heat Pump	Efficiency: min.[1] Economizer: 1433[2]	(two of three): Efficiency: + 10/5%[5] Flow control valve[7] Economizer: 50%[6]	(three of three): Efficiency: + 10/5%[5] Flow control valve[7] Economizer: 50%[6] (except for certain pre-1991 systems[8])	Efficiency: min.[1] Economizer: 1433[2,4] (except for certain pre-1991 systems[8])
4. Hydronic Economizer using Air-Cooled Heat Rejection Equipment (Dry Cooler)	Efficiency: min.[1] Economizer: 1433[2]	Efficiency: + 10/5%[5] Economizer: shall not decrease existing economizer capacity	Option A	Efficiency: min.[1] Economizer: 1433[2,4]
4a. Hydronic Economizer using ASHRAE Std 127 equipment	Efficiency: none[1] Economizer: 1433[2]	Efficiency: none[1] Economizer: 1433[2]	Efficiency: none[1] Economizer: 1433[2]	Efficiency: none[1] Economizer: 1433[2]
5. Air-Handling Unit (including fan coil units) where the system has an air-cooled chiller	Efficiency: min.[1] Economizer: 1433[2]	Economizer: 1433[2] if outside, otherwise shall not decrease existing economizer capacity	Option A (except for certain pre-1991 systems[8])	Option A (except for certain pre-1991 systems[8])
6. Air- Handling Unit (including fan coil units) and Water-cooled Process Equipment, where the system has a water-cooled chiller[10]	Efficiency: min.[1] Economizer: 1433[2]	Economizer: 1433[2] if outside, otherwise shall not decrease existing economizer capacity	Option A (except for certain pre-1991 systems[8] and certain 1991-2004 systems[9].)	Efficiency: min.[1] Economizer: 1433[2,4] (except for certain pre-1991 systems[8] and certain 1991-2004 systems[9])
7. Cooling Tower	Efficiency: min.[1] Economizer: 1433[2]	No requirements	Option A	Option A
8. Air-Cooled Chiller	Efficiency: min.[1] Economizer: 1433[2]	Efficiency: + 5%[11] Economizer: shall not decrease existing economizer capacity	Efficiency (two of two): (1) + 10%[12] and (2) multistage Economizer: shall not decrease existing economizer capacity	Efficiency: min.[1] Economizer: 1433[2,4]

9. Water-Cooled Chiller	Efficiency: min.[1] Economizer: 1433[2]	Efficiency (one of two): (1) + 10%[13]or (2) plate frame heat exchanger[15] Economizer: shall not decrease existing economizer capacity	Efficiency (two of two): (1) + 15%[14] and (2) plate-frame heat exchanger[15] Economizer: shall not decrease existing economizer capacity	Efficiency: min.[1] Economizer: 1433[2,4]
10. Boiler	Efficiency: min.[1] Economizer: 1433[2]	Efficiency: + 8%[16] Economizer: shall not decrease existing economizer capacity	Efficiency: + 8%[16] Economizer: shall not decrease existing economizer capacity	Efficiency: min.[1] Economizer: 1433[2,4]

1. Minimum equipment efficiency shall comply with Section 1411.1 and Tables 14-1A through M.
   "ASHRAE Std. 127 equipment" means equipment that both
   (a) is not subject to one of the rating standards in Tables 14-1A through M and
   (b) is within the scope of ASHRAE Std. 127-2001.
   Note that there is no minimum efficiency in Section 1411.1 for equipment not within the scope of the rating standards in Tables 14-1A through M. However, there may be a minimum efficiency associated with compliance with other criteria (e.g. Section 1433, Exception 9, Option d).
2. System and building shall comply with Section 1433 (including both the individual unit size limits and the total building capacity limits on units without economizer). It is acceptable to comply using one of the exceptions to Section 1433.
3. All equipment replaced in an existing building shall have air economizer complying with Sections 1413 and 1433 unless both the individual unit size and the total capacity of units without air economizer in the building is less than that allowed in Exception 1 to Section 1433.
4. All separate new equipment added to an existing building shall have air economizer complying with Sections 1413 and 1433 unless both the individual unit size and the total capacity of units without air economizer in the building is less than that allowed in Exception 1 to Section 1433.
5. Equipment shall have a capacity-weighted average cooling system efficiency:
   a. for units with a cooling capacity below 54,000 Btuh, a minimum of 10% greater than the requirements in Tables 14-1A and 14-1B (1.10 x values in Tables 14-1A and 14-1B).
   b. for units with a cooling capacity of 54,000 Btuh and greater, a minimum of 5% greater than the requirements in Tables 14-1A and 14-1B (1.05 x values in Tables 14-1A and 14-1B.
6. Minimum of 50% air economizer that is ducted in a fully enclosed path directly to every heat pump unit in each zone, except that ducts may terminate within 12 inches of the intake to an HVAC unit provided that they are physically fastened so that the outside air duct is directed into the unit intake. If this is an increase in the amount of outside air supplied to this unit, the outside air supply system shall be capable of providing this additional outside air and equipped with economizer control.
7. Have flow control valve to eliminate flow through the heat pumps that are not in operation with variable speed pumping control complying with Section 1432.2.2 for that heat pump.
   – When the total capacity of all units with flow control valves exceeds 15% of the total system capacity, a variable frequency drive shall be installed on the main loop pump.
   – As an alternate to this requirement, have a capacity-weighted average cooling system efficiency that is 5% greater than the requirements in note 5 (i.e. a minimum of 15%/10% greater than the requirements in Tables 14-1A and 14-1B (1.15/1.10 x values in Tables 14-1A and 14-1B)).
8. Systems installed prior to 1991 without fully utilized capacity are allowed to comply with Option B, provided that the individual unit cooling capacity does not exceed 90,000 Btuh.
9. Economizer not required for systems installed with water economizer plate and frame heat exchanger complying with previous codes between 1991 and June 2004, provided that the total fan coil load does not exceed the existing or added capacity of the heat exchangers.
10. For water-cooled process equipment where the manufacturers specifications require colder temperatures than available with waterside economizer, that portion of the load is exempt from the economizer requirements.
11. The air-cooled chiller shall have an IPLV efficiency that is a minimum of 5% greater than the IPLV requirements in Table 14-1C (1.05 x IPLV values in Table 14-1C).
12. The air-cooled chiller shall:
    a. have an IPLV efficiency that is a minimum of 10% greater than the IPLV requirements in Table 14-1C (1.10 x IPLV values in Table 14-1C), and

b. be multistage with a minimum of two compressors.

13. The water-cooled chiller shall have an IPLV or NPLV efficiency that is a minimum of 10% greater than the IPLV or NPLV requirements in Table 14-1C, Table 14-1K, Table 14-1L, or Table 14-1M (1.10 x IPLV or NPLV values in Table 14-1C, Table 14-1K, Table 14-1L, or Table 14-1M).
14. The water-cooled chiller shall have IPLV or NPLV efficiency that is a minimum of 15% greater than the IPLV or NPLV requirements in Table 14-1C, Table 14-1K, Table 14-1L, or Table 14-1M (1.15 x IPLV or NPLV values in Table 14-1C, Table 14-1K, Table 14-1L, or Table 14-1M).
15. Economizer cooling shall be provided by adding a plate-frame heat exchanger on the waterside with a capacity that is a minimum of 20% of the chiller capacity at standard ARI rating conditions.
16. The replacement boiler shall have an efficiency that is a minimum of 8% higher than the value in Table 14-1F (1.08 x value in Table 14-1F), except for electric boilers.

1132.3 Lighting and Motors.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1132.3 Lighting and Motors: Where the use in a space changes from one use in Table 15-1 to another use in Table 15-1, the installed lighting wattage shall comply with Section 1521 or 1531.

Other tenant improvements, alterations or repairs where 60 percent or more of the fixtures in a space enclosed by walls or ceiling-height partitions are new shall comply with Sections 1531 and 1532. (Where this threshold is triggered, the areas of the affected spaces may be combined for lighting code compliance calculations.) Where less than 60 percent of the fixtures in s apace enclosed by walls or ceiling-height partitions are new, the installed lighting wattage shall be maintained or reduced. Where 60 percent or more of the lighting fixtures in a suspended ceiling are new, and the existing insulation is on the suspended ceiling, the roof/ceiling assembly shall be insulated according to the provisions of Chapter 13, Section 1311.2.

Where new wiring is being installed to serve added fixtures and/or fixtures are being relocated to a new circuit (except as noted in the following paragraph), controls shall comply with Sections 1513.1 through 1513.5 and, as applicable, 1513.7. For compliance with Section 1513.3.2 for existing luminaires where the existing ballasts are not being changed, the number of required incremental steps of automatic daylighting control shall be equal to one plus the number of ballasts in the luminaire. In addition, office areas less than 300 ft2 enclosed by walls or ceiling-height partitions, and all meeting and conference rooms, and all school classrooms, shall be equipped with occupancy sensors that comply with Section 1513.6 and 1513.7. Where a new lighting panel (or a moved lighting panel) with all new raceway and conductor wiring from the panel to the fixtures is being installed, controls shall also comply with the other requirements in Sections 1513.6 and 1513.7.

Where new walls or ceiling-height partitions are added to an existing space and create a new enclosed space, but the lighting fixtures are not being changed, other than being relocated, the new enclosed space shall have controls that comply with Sections 1513.1 through 1513.2, 1513.4, and 1513.6 through 1513.7.

Those motors which are altered or replaced shall comply with Section 1511.

1133 Change of Occupancy or Use.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1133 Change of Occupancy or Use: Changes of occupancy or use shall comply with the following requirements:

a. Any unconditioned space that is altered to become semi-heated, cooled, or fully heated, or any semi-heated space that is altered to become cooled or fully heated space shall be required to be brought into full compliance with this Code. For spaces constructed prior to this Code, the installed heating output capacity shall not exceed 16 Btu/h per square foot unless the building envelope complies with Chapter 13. Existing warehouses and repair shops are considered unconditioned space unless they are indicated as conditioned space in DPD records or they were built after 1980 and they comply with the building envelope requirements for conditioned space in effect at the time of construction. (See the Seattle Mechanical Code for requirements for combustion appliances.)

b. Any Group R Occupancy which is converted to other than a Group R Occupancy shall be required to comply with all of the provisions of Sections 1130 through 1132 of this Code.

1144 Violations.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1144 Violations and Penalties: ((~~It shall be a violation of this Code for any person, firm or corporation to erect or construct any building, or remodel or rehabilitate any existing building or structure in the state, or allow the same to be done, contrary to any of the provisions of this Code.~~))

1144.1 Violations: It shall be a violation of this Code for any person, firm or corporation to erect, construct, enlarge, repair, move, improve, remove, convert, demolish, equip, occupy, inspect or maintain any building or structure in the City, contrary to or in violation of any of the provisions of this Code.

It shall be a violation of this Code for any person, firm or corporation to knowingly aid, abet, counsel, encourage, hire, commend, induce or otherwise procure another to violate or fail to comply with this Code.

It shall be a violation of this Code for any person, firm, or corporation to use any material or to install any device, appliance or equipment which does not comply with the applicable standards of this Code or which has not been approved by the building official.

1144.2 Notice of Violation: If after investigation the building official determines that standards or requirements of this code have been violated, the building official may serve a notice of violation upon the owner or other person responsible for the action or condition. The notice of violation shall state the standards or requirements violated, shall state what corrective action, if any, is necessary to comply with the standards or requirements, and shall set a reasonable time for compliance. The notice shall be served upon the owner or other responsible person by regular first class mail service addressed to the last known address of

such person. In addition, a copy of the notice may be posted at a conspicuous place on the property. The notice of violation shall be considered an order of the building official. Nothing in this subsection shall be deemed to limit or preclude any action or proceeding pursuant to Sections 102, 103 or 104 of the Seattle Building Code, and nothing in this section shall be deemed to obligate or require the building official to issue a notice of violation prior to the imposition of civil or criminal penalties in this section.

1144.3 Civil Penalties: Any person, firm or corporation failing to comply with the provisions of this code shall be subject to a cumulative civil penalty in an amount not to exceed $500 per day for each violation from the date the violation occurs or begins until compliance is achieved. In cases where the building official has issued a notice of violation, the violation will be deemed to begin, for purposes of determining the number of days of violation, on the date compliance is required by notice of violation. In any civil action for a penalty, the City has the burden of proving by a preponderance of the evidence that a violation exists or existed; the issuance of the notice of violation or of an order following a review by the Director is not itself evidence that a violation exists.

1144.4 Criminal Penalty: Any person who violates or fails to comply with this chapter shall be guilty of a gross misdemeanor subject to the provisions of Chapters 12A.02 and 12A.04, except that absolute liability shall be imposed for such a violation or failure to comply and none of the mental states described in Section 12A04.030 need be proved. The Director may request the City Attorney prosecute such violations criminally as an alternative to the civil penalty provision outlined in the code. Each day any person, firm, or corporation shall continue to violate or fail to comply with the provisions of this chapter sand each occurrence of a prohibited activity shall constitute a separate offense.

1144.5 Additional Relief: The building official may seek legal or equitable relief to enjoin any acts or practices and abate any condition which constitutes a violation of this code when civil or criminal penalties are inadequate to effect compliance. In any such action, the City has the burden of proving by a preponderance of the evidence that a violation exists or will exist; the issuance of the notice of violation or of an order following a review by the Director is not itself evidence that a violation exists or will exist.

1144.6 Notices: It shall be unlawful for any person to remove, mutilate, destroy or conceal any notice issued or posted by the building official pursuant to the provisions of this code, or any notice issued or posted by the building official in response to a natural disaster or other emergency.

The building official may record a copy of any order or notice with the Department of Records and Elections of King County.

The building official may record with the Department of Records and Elections of King County a notification that a permit has expired without a final inspection after reasonable efforts have been made to provide a final inspection.

1144.7 Review by the Director

1144.7.1. Any party affected by a notice of violation issued by the Director pursuant to Section 1144.2 may obtain a review of the notice by requesting such review in writing within ten days after service of the notice. When the last day of the period computed is a Saturday, Sunday, federal or City holiday, the period shall run until 5:00 p.m. of the next business day. Upon receipt of a request, the Director shall notify the person requesting the review of the date,

time, and place of the Director's review. The review shall not be less than ten nor more than twenty days after the request is received, unless otherwise agreed by the person requesting the review. Any person affected by the notice of violation may submit any written material to the Director on or before the date of the review.

1144.7.2. The review will consist of an informal review meeting held at the Department. A representative of the Director who is familiar with the case and the applicable regulations will attend. The Director's representative will consider any information presented by the persons attending and in the Department's enforcement file. At or after the review, the Director shall issue an order of the Director that may:

1. Sustain the notice of violation; or

2. Withdraw the notice of violation; or

3. Continue the review to a future date; or

4. Amend the notice of violation.

1144.7.3. The Director shall issue an Order of the Director containing the decision within a reasonable time after the conclusion of the review. The Director shall mail the order by regular first-class mail to the person or persons named in the notice of violation.

1150 Conflicts with other Codes.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1150 Conflicts with Other Codes

In case of conflicts among Codes enumerated in RCW 19.27.031 subsections (1), (2), (3) and (4) and this Code, the first named Code shall govern. The duct insulation requirements in this Code or a local jurisdiction's energy code, whichever is more stringent, supersede the requirements in the Mechanical Code.

Additional efficiency standards for electrical energy use may also appear in Seattle City Light service requirements, which should be consulted.

Where, in any specific case, different sections of this Code specify different materials, methods of construction or other requirements, the most restrictive shall govern. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable.

1160 Severability & Liability.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1160 Severability & Liability

1161 Severability: If any provision of this Code or its application to any person or circumstance is held invalid, the remainder of this Code or the application of the provision to other persons or circumstances is not affected.

The legislative body hereby declares that it would have passed this Code, and each section, subsection, clause or phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses, and phrases be declared unconstitutional.

1162 Liability: Nothing contained in this Code is intended to be nor shall be construed to create or form the basis for any liability on the part of ((~~any city or county~~))the City or its officers, employees or agents for any injury or damage resulting from the failure of a building to conform to the provisions of this Code, or by reason of or in consequence of any inspection, notice, order, certificate, permission of approval authorized or issued or done in connection with the implementation or enforcement of this Code, or by reason of any action or inaction on the part of the City related in any manner to the enforcement of this Code or by its officers or agents. The building official or any employee charged with the enforcement of this Code, acting in good faith and without malice for the City in the discharge of his/her duties, shall not thereby render himself/herself liable personally and he/she is hereby relieved from all personal liability for any damage that may accrue to persons or property as a result of any act required or by reason of any act or omission in the discharge of his/her duties.

1301 Scope.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1301 Scope: Conditioned buildings or portions thereof shall be constructed to provide the required thermal performance of the various components according to the requirements of this chapter. Unless otherwise approved by the building official, all spaces shall be assumed to be at least semi-heated.

EXCEPTIONS: 1. Greenhouses isolated from any conditioned space and not intended for occupancy.

2. As approved by the building official, spaces not assumed to be at least semi-heated.

3. Unconditioned Group U occupancy accessory to Group R occupancy.

4. Unstaffed equipment shelters or cabinets used solely for personal wireless service facilities.

5. Parking lot attendant booths no larger than 100 square feet, provided that the roof insulation is R-21 minimum and the wall insulation is R-13 minimum, unless otherwise allowed by Section 1310.

1310.2 Semi-Heated Spaces.

Discussion: Clarify that semi-heated spaces are calculated separately from other conditioned spaces. (Note that previous Seattle amendment to this section was incorporated into the 2006 Washington State Energy Code and so is no longer needed.)
Proposal: Amend 2006 WSEC as follows -

1310.2 Semi-Heated Spaces: All spaces shall be considered conditioned spaces, and shall comply with the requirements in Section 1310.1 unless they meet the following criteria for semi-heated spaces. The installed heating equipment output, in Climate Zone 1, shall be 3 Btu/(h • ft^2) or greater but not greater than 8 Btu/(h • ft^2) and in Climate Zone 2, shall be 5 Btu/(h • ft^2) or greater but not greater than 12 Btu/(h • ft^2).

For semi-heated spaces, the building envelope shall comply with the same requirements as that for conditioned spaces in Section 1310.1. However, semi-heated spaces shall be calculated separately from other conditioned spaces for compliance purposes.

EXCEPTION: For semi-heated spaced heated by other fuels only, wall insulation is not required for those walls that separate semi-heated spaces (see definition in Section 201.1) from the exterior provided that the space is heated solely by a heating system controlled by a thermostat with a maximum setpoint capacity of 45ºF, mounted no lower than the heating unit.

1311.6 Radiant Floors.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1311.6 Radiant Floors (on or below grade): Slab-on-grade insulation shall extend downward from the top of the slab a minimum distance of 36 inches or downward to the top of the footing and horizontal for an aggregate of not less than 36 inches.

((~~If required by the building official where soil conditions warrant such insulation, t~~)) The entire area of a radiant floor shall be thermally isolated from the soil. Where a soil gas control system is provided below the radiant floor, which results in increased convective flow below the radiant floor, the radiant floor shall be thermally isolated from the sub-floor gravel layer.

1312.2 Solar Heat Gain Coefficient and Shading Coefficient.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1312.2 Solar Heat Gain Coefficient and ((~~Shading Coefficient~~))Visible Transmittance: Solar Heat Gain Coefficient (SHGC) and Visible Transmittance (VT), shall be determined, certified and labeled in accordance with the National Fenestration Rating Council (NFRC) Standard by a certified, independent agency, licensed by the NFRC.

EXCEPTIONS: 1. Shading coefficients (SC) or solar heat gain coefficient for the center of glass shall be an acceptable alternate for compliance with solar heat gain coefficient requirements. Shading coefficients or solar heat gain coefficient for the center of glass for glazing shall be taken from Chapter 31 of Standard RS-1 or from the manufacturer's ((~~test~~)) data using a spectral data file determined in accordance with NFRC 300.

2. For the purposes of 1323, Exception 1, visible transmittance for the center of the glazing assembly shall be taken from Chapter 31 of Standard RS-1 or from the manufacturer's data using a spectral data file determined in accordance with NFRC 300.

Note that using the exception for the SHGC for the center-of-glass does not give the full credit for the overall product (including the frame) that the NFRC-certified SHGC does. Though the SHGC for the frame is not zero (the ASHRAE Handbook of Fundamentals indicates that the SHGC can range from 0.11-0.14 for metal frames and from 0.02 to 0.07 for wood/vinyl/fiberglass frames), the SHGC for the frame is invariably lower than that for the glass. Consequently, an NFRC-certified SHGC will generally be lower.

Conversely, the VT for the center-of-glass overstates the VT for the overall product (including the frame). The VT for the frame is zero. Consequently, an NFRC-certified VT will always be lower. For this reason, Exception 2 to Section 1312.2 is only applicable to Exception 1 in Section 1323. It is not applicable to other sections.

1314 Air Leakage.

Discussion: Modify to better address air leakage per ASHRAE/IESNA Standard 90.1, addendum c, and IECC 502.4.2.
Proposal: Amend 2006 WSEC as follows -

1314 Air Leakage

1314.1 (~~Building Envelope: The requirements of this section shall apply to building elements separating conditioned from unconditioned spaces. Exterior joints around windows and door frames, openings between walls and foundation, between walls and roof and wall panels; openings at penetrations of utility services through walls, floors and roofs; and all other openings in the building envelope shall be sealed, caulked, gasketed or weatherstripped to limit air leakage.~~))**Building Envelope Sealing.** The following areas of the building envelope shall be sealed, caulked, gasketed, or weather-stripped to minimize air leakage:

a. joints around fenestration and door frames,
b. junctions between walls and foundations, between walls at building corners, between walls and structural floors or roofs, and between walls and roof or wall panels,
c. openings at penetrations of utility services through roofs, walls, and floors,
d. site-built fenestration and doors,
e. building assemblies used as ducts or plenums,
f. joints, seams, and penetrations of vapor retarders,
g. all other openings in the building envelope.

1314.2 Glazing and Doors: Air leakage for fenestration and doors shall be determined in accordance with NFRC 400 or AAMA/WDMA/CSA101/I.S.2/A440. Air leakage shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be labeled and certified by the manufacturer. Air leakage shall not exceed 1.0 cfm/ft^2 for glazed swinging entrance doors and for revolving doors and 0.3 cfm/ft^2 for all other products. ((~~Doors and operable glazing separating conditioned from unconditioned space shall be weatherstripped. Fixed windows shall be tight fitting with glass retained by stops with sealant or caulking all around.~~))

EXCEPTIONS: 1. Openings that are required to be fire resistant.

2. Field-fabricated fenestration and doors that are weather-stripped or sealed in accordance with 1314.1.

3. For garage doors, air leakage determined by test at standard test conditions in accordance with ANSI/DASMA 105 shall be an acceptable alternate for compliance with air leakage requirements.

4. Units without air leakage ratings produced by small business that are weather-stripped or sealed in accordance with 1314.1.

1314.3 Building Assemblies Used as Ducts or Plenums: Building assemblies used as ducts or plenums shall be sealed, caulked and gasketed to limit air leakage.

1314.4 Recessed Lighting Fixtures: When installed in the building envelope, recessed lighting fixtures shall by Type IC rated, and certified under ASTM E283 to have no more than 2.0 cfm air movement from the conditioned space to the ceiling cavity. The lighting fixture shall be tested at 75 Pascals or 1.57 lbs/ft2 pressure difference and have a label attached, showing compliance with this test method. Recessed lighting fixtures shall be installed with a gasket or caulk between the fixture and ceiling to prevent air leakage.

1314.5 Loading Dock Weatherseals. Cargo doors and loading dock doors shall be equipped with weatherseals to restrict infiltration when vehicles are parked in the doorway.

1314.6 Vestibules. Building entrances that separate conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. Interior and exterior doors shall have a minimum distance between them of not less than 7 ft when in the closed position. The exterior envelope of conditioned vestibules shall comply with the requirements for a conditioned space. Either the interior or exterior envelope of unconditioned vestibules shall comply with the requirements for a conditioned space.

EXCEPTIONS: 1. Building entrances with revolving doors.

2. Doors not intended to be used as a building entrance.

3. Building entrances in buildings that are less than four stories above grade and less than 10,000 ft^2 in area.

4. Doors that open directly from a space that is less than 3000 ft^2 in area and is separate from the building entrance.

1322 Opaque Envelope.

Discussion: (1) No Seattle changes (retain existing Seattle amendment).
(2) Revise slab edge exception 2 for consistency with changes in Table 13-1.
(3) Minor change to roof insulation exception 3 (retain existing Seattle amendment, but revise for consistency with new Table 10-7G and delete portion of exception 3b that is no longer applicable due to changes to Table 13-1).
Proposal: Amend 2006 WSEC as follows -

1322 Opaque Envelope: Roof/ceilings, opaque exterior walls, opaque doors, floors over unconditioned space, below-grade walls, slab-on-grade floors and radiant floors enclosing conditioned spaces shall be insulated according to Section 1311 and Tables 13-1 or 13-2. Compliance with nominal R-values shall be demonstrated for the thermal resistance of the added insulation in framing cavities and/or insulated sheathing only. Nominal R-values shall not include the thermal transmittance of other building materials or air films.

For metal frame assemblies used in spaces with electric resistance space heat, compliance shall be demonstrated with the component U-factor for the overall assembly based on the assemblies in Chapter 10.

Area-weighted averaging of the R-value is not allowed. When showing compliance with R-values, the minimum insulation R-value for all areas of the component shall comply with Table 13-1. When calculating compliance using U-factors, area-weighted averaging is allowed. Where insulation is tapered (e.g. roofs), separate assembly U-factors shall be calculated for each four-foot section of tapered insulation.

EXCEPTIONS: 1. Opaque smoke vents are not required to meet insulation requirements.
2. For prescriptive compliance only:
((~~a. For glazing areas that are 30% and less of the gross wall area, t~~))The insulation of the perimeter edge of an above grade floor slab which penetrates the exterior wall may be reduced to R-5 provided the glazing U-factor is reduced to U-0.05 below that required in Tables 13-1 and 13-2.
((~~b. For glazing areas that exceed 30% of the gross wall area, the perimeter edge of an above grade floor slab which penetrates the exterior wall may be left uninsulated provided the glazing U-factor is reduced by U-0.10 below that required in Tables 13-1 and 13-2.~~))
3. For roofs with continuous rigid insulation on the top of the roof, the insulation R-value may be averaged for compliance with minimum prescriptive R-values only, provided that both:
a. the minimum insulation is no less than R-5 (but not including area within 6 inches of each roof drain), and
b. the area-weighted average insulation is R-50 (in lieu of R-30).

1323 Glazing.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1323 Glazing: Glazing shall comply with Section 1312 and Tables 13-1 or 13-2. All glazing shall be, at a minimum, double glazing. In addition, all glazing assemblies shall have at least one low-emissivity coating unless the glazing assembly has an overall U-factor that complies with the values in Table 13-1.

EXCEPTIONS: 1. Vertical glazing located on the display side of the street level story of a retail occupancy or where there is a street level transparency requirement in the Seattle Land Use Code provided the glazing:

a. (i) is double-glazed with a minimum 1/2 inch airspace and with a low-e coating having a maximum emittance of e-0.40 in any type of frame or;

(ii) has an area weighted U-factor of 0.60 or less.

(U-factor calculations shall use overall assembly U-factors. When this exception is used, there are no SHGC requirements), and

b. has a visible transmittance of (i) 0.60 or greater for the center of the glazing assembly in any type of frame or (ii) has an area-weighted visible transmittance for the overall assembly including the frame of 0.52 or greater for fixed glazing and 0.44 or greater for operable glazing. Visible transmittance shall be determined in accordance with Section 1312.2, and,

((~~b.~~))c. does not exceed 75 % of the gross exterior wall area of the display side of the street level story. However, if the display side of the street level story exceeds 20 feet in height, then this exception may only be used for the first 20 feet of that story.

When this exception is utilized, separate calculations shall be performed for these sections of the building envelope and these values shall not be averaged with any others for compliance purposes. The 75% area may be exceeded on the street level, if the additional glass area is provided from allowances from other areas of the building.

2. Single glazing for ornamental, security or architectural purposes shall be included in the percentage of the total glazing area, U-factor calculation and SHGC as allowed in the Tables 13-1 or 13-2. The maximum area allowed for the total of all single glazing is 1% of the gross exterior wall area.

1323.1 Area: The percentage of total glazing (vertical and overhead) area relative to the gross exterior wall area shall not be greater than the appropriate value from Tables 13-1 or 13-2 for the vertical glazing U-factor, overhead glazing U-factor and solar heat gain coefficient selected.

1323.2 U-Factor: The area-weighted average U-factor of vertical glazing shall not be greater than that specified in Tables 13-1 or 13-2 for the appropriate area and solar heat gain coefficient. The area-weighted average U-factor of overhead glazing shall not be greater than that specified in Tables 13-1 or 13-2 for the appropriate area and solar heat gain coefficient. U-factors for glazing shall be determined in accordance with Section 1312.

1323.3 Solar Heat Gain Coefficient: The area-weighted average solar heat gain coefficient of all glazing shall not be greater than that specified in Tables 13-1 or 13-2 for the appropriate area and U-factor.

EXCEPTIONS: 1. Glazing separating conditioned space from semi-heated space or unconditioned space.

2. Vertical glazing which is oriented within 45 degrees of north shall be allowed to have a maximum solar heat gain coefficient SHGC-0.10 above that required in Table 13-1.

3. For demonstrating compliance for vertical glazing only, the SHGC in the proposed building shall be allowed to be reduced by using the multipliers in the table below for each glazing product shaded by permanent projections that will last as long as the building itself.

Projection Factor	SHGC Multiplier (All Orientations except North-oriented)	SHGC Multiplier (North-Oriented)
0 - 0.10	1.00	1.00
<0.10 - 0.20	0.91	0.95
<0.20 - 0.30	0.82	0.91
<0.30 - 0.40	0.74	0.87
<0.40 - 0.50	0.67	0.84
<0.50 - 0.60	0.61	0.81
<0.60 - 0.70	0.56	0.78
<0.70 - 0.80	0.51	0.76
<0.80 - 0.90	0.47	0.75
<0.90 - 1.00	0.44	0.73

Projection factor (PF) is the ratio of the horizontal depth of the external shading projection (A) divided by the sum of the height of the fenestration and the distance from the top of the fenestration to the bottom of the farthest point of the external shading projection (B), in consistent units. (See Exhibit 1323.3.)

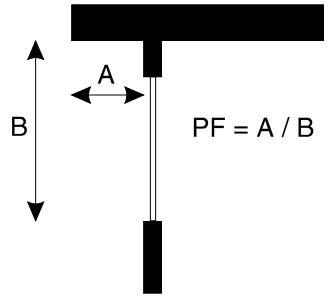

Exhibit 1323.3

1331 General.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1331 General: Buildings or structures whose design heat loss rate (UA_p) and solar heat gain coefficient rate (SHGC * A_p) are less than or equal to the target heat loss rate (UA_t) and solar heat gain coefficient rate (SHGC * A_t) shall be considered in compliance with this section. The stated U-factor, F-factor or allowable area of any component assembly, listed in Tables 13-1 or 13-2, such as roof/ceiling, opaque wall, opaque door, glazing, floor over conditioned space, slab-on-grade floor, radiant floor or opaque floor may be increased and the U-factor or F-factor for other components decreased, provided that the total heat gain or loss for the entire building envelope does not exceed the total resulting from compliance to the U-factors, F-factors or allowable areas specified in this section.

EXCEPTIONS:
1. Compliance is also allowed to be shown using RS-32 for Climate Zone 1.
2. The prescriptive approach in Section 1323 may be used for that portion of the building envelope that complies with Exception 1 to Section 1323.

1333 UA Calculations.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1333 UA Calculations: The target UA_t and the proposed UA_p shall be calculated using Equations 13-1 and 13-2 and the corresponding areas and U-factors from Table 13-1 or 13-2. For the target UA_t calculation, the overhead glazing shall be located in roof/ceiling area and the remainder of the glazing allowed per Table 13-1 or 13-2 shall be located in the wall area. Where insulation is tapered, separate assembly U-factors shall be calculated in accordance with Section 1322.

Table 13-1 Building Envelope Requirements.

Discussion: Revise opaque envelope and glazing requirements to achieve greater energy efficiency as follows. For opaque envelope, revise roof, wall, and floor U-factors to match existing criteria for electric resistance space heat, and revise footnote 2 for consistency with the Advanced Energy Design Guides (AEDG) developed by AIA, ASHRAE, IES, NBI (New Buildings Institute), the USDOE (U.S. Department of Energy), and the USGBC (U.S. Green Building Council). Note that the insulation R-values for attic roofs, metal stud walls, and wood and steel joist floors also match that in Standard 90.1, addendum as. For glazing, revise U-factors to match existing criteria for electric resistance space heat, revise SHGC to require either a lower SHGC or a minimum overhang Projection Factor (PF) for south- and west-oriented glazing, make corresponding changes to footnotes 6 and 7, and add explanatory footnote 9.

For residential buildings (Group R occupancy), the WSEC previously contained differences in building envelope requirements based on space heating system type. The Washington State Building Code Council (WSBCC), in its adoption of the 2006 WSEC, eliminated those differences. The WSBCC applied the more stringent electric-resistance building envelope criteria to all residential buildings.

The proposed revisions to the Seattle Energy Code build on this approach by applying the same concept to nonresidential buildings. The 2006 Seattle Energy Code would increase the stringency for the opaque envelope and glazing in nonresidential buildings to be generally comparable to the current criteria for buildings with electric resistance space heat. These criteria generally reflect the direction in Standard 90.1 and the AEDG. Also, the glazing U-factor criteria are familiar to designers and contractors as they match what is already being installed in high-rise residential buildings.

Proposal: Amend 2006 WSEC as follows -

TABLE 13-1
BUILDING ENVELOPE REQUIREMENTS FOR CLIMATE ZONE 1

Minimum Insulation R-Values or Maximum Component U-Factors for Zone 1

Building Components

Space Heat Type	Components					
	Roofs Over Attic[3]	**All Other Roofs**[3]	**Opaque Walls**[1,2]	**Opaque Doors**	**Floor Over Uncond Space**	**Slab-On-Grade**[5]
1. Electric resistance heat** and wood-frame portions of all others	U=0.031 or R-38	U=0.034 or R-30	U=0.062 or R-19	U=0.60 for metal door; U=0.50 for wood, fiberglass, other door	U=0.029 or R-30	F=0.54 or R-10
2. All others including heat pumps and VAV	U=0.031or (a) Metal framing: R-38 cavity insul. + R-15 continuous insulation ((~~R-30 or U=0.036~~))	U=0.034 or (a) Insulation entirely above deck: R-30 continuous insulation (b) Metal buildings: R-19 cavity insul. + R-15 continuous insulation ((~~R-21 or U=0.046~~))	U=0.062 or (a) Metal framing: R-13 cavity insul. + R-7.5 continuous insulation, and R-15 continuous insulation for peripheral edges of intermediate concrete floors (((~~(a) Metal framing: R-19 or U=0.109 (b) Wood framing & framing other than metal: R-19 or =0.062~~))	U=0.60 for metal door; U=0.50 for wood, fiberglass, other door	U=0.029 or (a) Concrete floor: R-30 continuous insulation (b) Metal joist: R-19 cavity insul. + R-15 continuous insulation ((~~R-19 or U=0.056~~))	F=0.54 or R-10

**** Compliance with nominal prescriptive R-values requires wood framing**

Maximum Glazing Areas and U-Factors and Maximum Glazing Solar Heat Gain Coefficients for Zone 1

GLAZING

Maximum Glazing Area as % of Wall	0% to 30%			>30% to 45%		
	Maximum U-Factor		Max SHGC[4,8,9]	Maximum U-Factor		Max SHGC[4,8,9]
	VG	OG		VG	OG	
1. Electric resistance heat[7]	0.40	0.48 ((~~0.60~~))	0.35 without PF, or 0.40 with PF > 0.3 for south and west	**PRESCRIPTIVE PATH NOT ALLOWED**		
2. All others including heat pumps and VAV[6,7]	0.40 ((~~0.55~~))	0.48 ((~~0.70~~))	0.35 without PF, or 0.40 with PF > 0.3 for south and west ((~~0.45~~))	0.40 ((~~0.45~~))	0. 48 ((~~0.60~~))	0.35 without PF, or 0.40 with PF > 0.3 for south and west

Footnotes

1. **Below Grade Walls:**
When complying by the prescriptive approach, Section 1322:

a) walls insulated on the interior shall use opaque wall values,
b) walls insulated on the exterior shall use a minimum of R-10 insulation,
c) walls shall be insulated for the first 10 feet below grade. (There shall be no credit for those portions of below grade walls and footings that are more than 10 feet below grade, and those portions below 10 feet shall not be included in the gross exterior wall area.)

When complying by the component performance approach, Section 1331:
a) walls insulated on the interior shall use the opaque wall values when determining U_{bgwt} ,
b) walls insulated on the exterior shall use a target U-factor of U=0.070 for U_{bgwt} ,
c) the calculations shall include the first 10 feet of walls below grade. (Those portions of below grade walls and footings that are more than 10 feet below grade shall not be included in the gross exterior wall area and shall not be included when determining A_{bgwt} and A_{bgw}.

2. **Concrete and Masonry Walls:** If the area weighted heat capacity of the total opaque above grade wall is a minimum of 9.0 Btu/ft^2 • °F, then:
   a) The area weighted average U-factor may be increased to ((~~U-0.15 maximum, or a minimum additional R-5.7 continuous insulation uninterrupted by framing~~)) 0.071 maximum for interior insulation:
      i) minimum R-19 insulation between wood studs; or
      ii) minimum R-13 cavity insulation between metal studs + R-6 continuous insulation; or
      iii) minimum R-15.2 insulation held in place solely by 1 inch metal clips at 24 inches on center vertically and 16 inches on center horizontally; or
   b) 0.073 for integral and exterior insulation for insulation position as defined in Chapter 2.
      i) minimum additional R-12 continuous insulation uninterrupted by framing.
      ((~~The wall may be ASTM C90 concrete block walls, ungrouted or partially grouted at 32 in. or less on center vertically and 48 in. or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu-in/h•ft^2•°F.~~))
   -- Individual walls with heat capacities less than 9.0 Btu/ft^2 •°F and below grade walls shall meet opaque wall requirements listed above.
   -- Glazing shall comply with the glazing requirements listed above.
3. **Roof Types:** A roof over attic is where the roof structure has at least 30 inches clear distance from the top of the bottom chord of a truss or ceiling joist to the underside of the sheathing at the roof ridge, and the ceiling is attached to the ceiling joist or the bottom of the truss or ceiling joist. Anything else is considered all other roofs.
4. **SHGC (Solar Heat Gain Coefficient per Section 1312.2):** May substitute Maximum Shading Coefficient (SC) for SHGC (See Chapter 2 for definition of Shading Coefficient).
5. **Radiant Floors:** Where insulation is required under the entire slab, radiant floors shall use a minimum of R-10 insulation or F=0.55 maximum. Where insulation is not required under the entire slab, radiant floors shall use R-10 perimeter insulation according to Section 1311.6 or F=0.78 maximum.
6. **Prescriptive Alternate** (not applicable to Target UA or annual energy analysis)**:** For the prescriptive building envelope option only, for other than electric resistance heat only, glazing may comply with the following:

Maximum Glazing Area as % of Wall:	Maximum U-Factor		Max.
	VG	OG	SHGC[4]
>45% to 50%	0.35	0.42	0.30

7. **Prescriptive Alternate** (not applicable to Target UA or annual energy analysis): For glazed wall systems, assemblies with all of the following features are deemed to satisfy the vertical glazing U-factor requirement of U-0.40 and the overhead glazing U-factor or U-0.48:
   a. Double glazing with a minimum 1/2 inch gap width, having a low-emissivity coating with e=0.10 maximum, with 90% minimum argon gas fill, and a non-aluminum spacer (as defined in footnote 1 to Table 10-6B), and
   b. Frame that is thermal break aluminum (as defined in footnote 7 to Table 10-6A), fiberglass, wood, aluminum clad wood, vinyl, aluminum clad vinyl, or reinforced vinyl.
8. **Daylighting with Plastic Skylights.** For plastic skylights, the SHGC is allowed to be SHGC-0.65 maximum provided that:.
   a. the visible transmittance (VT) is greater than the SHGC and
   b. the skylight area is no greater than 6% of the overhead daylight zone.
9. **Projection Factor (PF).** See definition of projection factor in 1323.3 Exception 3 and Exhibit 1323.3. South-oriented glazing is vertical glazing oriented within 45 degrees of due south. West-oriented glazing is vertical glazing oriented within 45 degrees of due west. If area-weighted average projection factor for south-oriented and west-oriented vertical glazing is greater than 0.3, then the area-weighted average SHGC for all vertical glazing shall not exceed 0.40.

1402 Mechanical Ventilation.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1402 Mechanical Ventilation: The minimum requirements for ventilation shall comply with the ((~~Washington State Ventilation and Indoor Air Quality Code (WAC 51-13)~~)) Seattle Mechanical Code.

1411.1 HVAC Equipment Performance Requirements, General.

Discussion: (1) No Seattle changes (retain existing Seattle amendment);
(2) Add clarifying note that equipment subject to an ARI Standard shall be listed in the ARI certification program;
(3) Modify exception to indicate that chillers designed for non-standard conditions must show compliance with the nearest value in Tables 14-1K, 14-1L, and 14-1M; and
(4) Add language that addresses equipment not rated.
Proposal: Amend 2006 WSEC as follows -

1411.1 General: Equipment shall have a minimum performance at the specified rating conditions not less than the values shown in Tables 14-1A through 14-1G. If a nationally recognized certification program exists for a product covered in Tables 14-1A through 14-1G, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program.

If equipment is subject to an ARI Standard, it shall be listed in the ARI certification program.

EXCEPTION: Water-cooled centrifugal water-chilling packages that are not designed for operation at ARI Standard 550/590 test conditions of 44°F leaving chilled water temperature and 85°F entering condenser water temperature with 3 gpm/ton condenser water flow shall have a minimum NPLV rating as shown in Tables 14-1K, L, and M. The table values are only specified for the following full load design ranges:

Leaving Chiller Water Temp.:	40 to 48°F
Entering Condenser Water Temp.:	75 to 85°F
Condensing Water Temp. Rise:	5 to 15°F
Glycol percent	0%

Chillers designed to operate outside of these ranges shall have a code compliant selection at the nearest table operating point based on an all-water system. Non-standard Part Load Value (NPLV) is defined as single number part-load efficiency figure of merit for chillers references to conditions other than IPLV conditions. Design condenser water flow rate shall not be less than 2.5 gpm/ton.

Equipment not listed in Tables 14-1A to 14-1G is allowed to be used.

Gas-fired and oil-fired forced air furnaces with input ratings ≥ 225,000 Btu/h (65 kW) and all unit heaters shall also have an intermittent ignition or interrupted device (IID), and have either mechanical draft (including power venting) or a flue damper. A vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. All furnaces with input ratings ≥ 225,000 Btu/h (65 kW), including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75% of the input rating.

Electric furnaces over 15kW shall have a minimum of two stages of control for heating.

Cooling towers serving chilled water systems with airside economizer complying with Section 1433 without using the exceptions shall be selected to be able to maintain a return condenser water temperature to the tower of 86°F or less at peak design conditions.

Hydronic heat pump and other cooling and refrigeration equipment (e.g. icemakers, walk-in coolers) shall not use domestic water only one time before dumping it to waste (no single pass water cooling systems are allowed). The only exceptions are: medical and dental equipment; equipment using less than 1 gpm; replacement of existing icemakers; or use of single pass cooling during power outages and other emergencies.

1411.2 Rating Conditions.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1411.2 Rating Conditions: Cooling equipment shall be rated at ARI test conditions and procedures when available. Where no applicable procedures exist, data shall be furnished by the equipment manufacturer.

If equipment is rated in accordance with an ARI Standard, it shall be rated at Standard (not "design") ARI Rating Conditions.

1411.4 Packaged Electric Heating and Cooling Equipment.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1411.4 Packaged and Split System Electric Heating and Cooling Equipment: Packaged and split system electric equipment providing both heating and cooling with a total cooling capacity greater than 20,000 Btu/h shall be a heat pump.

EXCEPTION: Unstaffed equipment shelters or cabinets used solely for personal wireless service facilities.

1411.5 Heating Systems in Unenclosed Spaces.

Discussion: (1) No Seattle changes (retain existing Seattle amendment),
(2) Require occupancy sensor to reduce energy waste.
Proposal: Amend 2006 WSEC as follows -

1411.5 Heating Systems in Unenclosed Spaces. Where heating is provided to unenclosed spaces, only radiant heating systems shall be used unless otherwise approved by the building official. The heating system shall be controlled by an occupancy sensor. An unenclosed space is one that is not substantially surrounded by solid surfaces such as walls, floors, roofs, and openable devices such as doors and operable windows. Warehouses and repair garages are considered enclosed spaces.

1412.4 Setback and Shut-Off.

Discussion: (1) No Seattle changes (retain existing Seattle amendment);
(2) Revise exceptions allowing non-motorized dampers in 1412.4.1 for consistency with Standard 90.1, Section 6.4.3.3.3.

Proposal: Amend 2006 WSEC as follows -

1412.4 Setback and Shut-Off: HVAC systems shall be equipped with automatic controls capable of accomplishing a reduction of energy use through control setback or equipment shutdown during periods of non-use or alternate use of the spaces served by the system. The automatic controls shall:

a. Have a minimum seven-day clock and be capable of being set for seven different day types per week,

b. Be capable of retaining programming and time settings during loss of power for a period of at least ten hours, and

c. Include an accessible manual override, or equivalent function (e.g., telephone interface), that allows temporary operation of the system for up to two hours.

EXCEPTIONS: 1. Systems serving areas which require continuous operation at the same temperature setpoint.
2. Equipment with full load demands of 2 kW (6,826 Btu/h) or less may be controlled by readily accessible manual off-hour controls.
3. Systems controlled by an occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.
4. Systems controlled solely by a manually operated timer capable of operating the system for no more than two hours.

1412.4.1 Dampers: Outside air intakes, exhaust outlets and relief outlets serving conditioned spaces shall be equipped with motorized dampers which close automatically when the system is off or upon power failure. Stair shaft and elevator shaft smoke relief openings shall be equipped with normally open (fails to open upon loss of power) dampers. These dampers shall remain closed until activated by the fire alarm system or other approved smoke detection system.

EXCEPTIONS: 1. Systems serving areas which require continuous operation.
2. Combustion air intakes.
3. Gravity (nonmotorized) dampers are acceptable in systems with a design outdoor air intake or exhaust capacity of 300 cfm or less.((~~buildings less than three stories in height.~~))
4. ((~~Gravity (nonmotorized) dampers are acceptable in exhaust and relief outlets in the first story and levels below the first story of buildings three or more stories in height.~~))Reserved.
5. Type 1 Grease hoods exhaust.

Dampers installed to comply with this section, including dampers integral to HVAC equipment, shall have a maximum leakage rate when tested in accordance with AMCA Standard 500 of:

a. Motorized Dampers: 10 cfm/ft^2 of damper area at 1.0 inch w.g.

b. Nonmotorized Dampers: 20 cfm/ft^2 of damper area at 1.0 inch w.g., except that for nonmotorized dampers smaller than 24 inches in either dimension: 40 cfm/ft^2 of damper area at 1.0 inch w.g.

Dampers used as a component of packaged HVAC equipment shall comply with the damper leakage requirements, unless it is the lowest leakage available as a factory option. Drawings shall indicate compliance with this section.

1412.4.2 Optimum Start Controls: Heating and cooling systems with design supply air capacities exceeding 10,000 cfm shall have optimum start controls. Optimum start controls shall be designed to automatically adjust the start time of an HVAC system each day to bring the space to desired occupied temperature levels immediately before scheduled occupancy. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint and the amount of time prior to scheduled occupancy.

1412.6 Combustion Heating Equipment Controls.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1412.6 Combustion Heating Equipment Controls: Combustion heating equipment with a capacity over 225,000 Btu/h shall have modulat((~~ing~~))ed or staged combustion control. Boilers shall have proportionately-modulated or staged combustion control to control both the fuel and the air.

EXCEPTIONS: 1. Boilers under 1,000,000 Btu/h input capacity.
2. Radiant heaters.
3. Systems with multiple boilers which are sequentially-staged.

Boilers shall comply with the reset requirements in Section 1432.2.

1412.9 Enclosed Parking Garage Ventilation.

Discussion: Delete existing Seattle amendment and refer to the Seattle Mechanical Code as this issue is now addressed in Section 404 of that document.
Proposal: Amend 2006 WSEC as follows -

1412.9 Enclosed Parking Garage Ventilation. See the Seattle Mechanical Code, Section 404 for requirements for controls for parking garage ventilation.

1413.1 Economizer Operation.

Discussion: (1) No Seattle changes (retain existing Seattle amendment to delete exception), (2) Clarify that water economizers are only allowed by limited exceptions.
Proposal: Amend 2006 WSEC as follows -

1413.1 Operation: Air economizers shall be capable of automatically modulating outside and return air dampers to provide 100% of the design supply air as outside air to reduce or eliminate the need for mechanical cooling. Air economizers shall be used for RS-29 analysis base case for all systems without exceptions in Sections 1413, 1423, or 1433. Water economizers, when allowed by Section 1132.2 exception 1 or Section 1433 exception 9, shall be capable of providing the total concurrent cooling load served by the connected terminal equipment lacking airside economizer, at outside air temperatures of 45°F dry-bulb/40°F wet-bulb and below. For this calculation, all factors including solar and internal load shall be the same as those used for peak load calculations, except for the outside temperatures.

((~~EXCEPTION: Water economizers using air-cooled heat rejection equipment may use a 35°F dry-bulb outside air temperature for this calculation. This exception is limited to a maximum of 20 tons per building.~~))

Note that this requirement will result in a larger cooling tower.

1413.5 Economizer Heating System Impact.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1413.5 Economizer Heating System Impact: Any HVAC system that increases the building heating energy use during economizer operation is not allowed (e.g. single-fan/dual-duct systems and multizone systems).

EXCEPTIONS: 1. Where the heating is allowed by Section 1435.

2. Water source heat pump systems that comply with Section 1433, Exception 7.

Note that single-fan/dual-duct systems and multizone systems do not comply with this requirement. This is because economizer operation lowers the temperature of the air entering the hot deck heating coil, increasing its energy use. In order to use this type of system, the system must meet one of the economizer exceptions and have neither type of economizer. (Another resolution is to use a dual-fan/dual-duct system where the hot deck fan supplies only return air or return air plus minimum ventilation air.)

This requirement will not affect three-deck multizone since they cannot work with an air economizer in any case (it would make the neutral deck a cold deck).

An exception to the heating impact is provided for economizers on VAV systems that cause zone level heating to increase due to a reduction in supply air temperature. Reducing supply air temperatures on a cooling-VAV system will reduce fan energy (particularly if the system has a variable speed drive), offsetting the energy lost due to increased reheat energy.

See the discussion and diagrams of Section 6.5.1.4 of ASHRAE/IESNA Standard 90.1 in the Users Manual.

1414 Ducting Systems.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1414 Ducting Systems

1414.1 Sealing: Duct work which is designed to operate at pressures above ½ inch water column static pressure shall be sealed ((~~in accordance with Standard RS-7. Extent of sealing required is~~))as follows:

1. ((~~Static pressure: ½ inch to 2 inches; seal transverse joints.~~)) Reserved.

2. Static pressure: ((~~2~~)) ½ inches to 3 inches; seal all transverse joints and longitudinal seams. Spiral lock seams in round and flat oval ductwork do not require sealing, however, other seams shall be sealed.

3. Static pressure: Above 3 inches; seal all transverse joints, longitudinal seams and duct wall penetrations.

((~~Duct tape and other pressure sensitive tape shall not be used as the primary sealant where ducts are designed to operate at static pressure of 1 inch W.C. or greater.~~))

All low-pressure supply and return air systems not located entirely within the

conditioned space, including the unconditioned side of enclosed stud bays or joist cavities/spaces used to transport air, shall be securely fastened and sealed. Ductwork shall be sealed using welds, gaskets, mastic, or mastic-plus-embedded-fabric tape. Enclosed stud bays or joist cavities/spaces used to transport air shall be sealed using mastic-plus-embedded-fabric tape or, when drywall is used to enclose the air system, drywall mud and tape. Duct tape is not permitted as a sealant on any ducts.

EXCEPTION: Fibrous glass duct systems installed in accordance with standard UL 181A and flexible duct systems installed in accordance with standard UL 181B may use tapes listed for these systems.

Note that longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod or wire. All other connections are considered transverse joints, including but not limited to spin-ins, taps and other branch connections, access door frames and jambs, duct connections to equipment.

1414.2 Insulation: Ducts and plenums that are constructed and function as part of the building envelope, by separating interior space from exterior space, shall meet all applicable requirements of Chapter 13. These requirements include insulation installation, moisture control, air leakage, and building envelope insulation levels. ((~~Unheated equipment rooms with combustion air louvers shall be isolated from the conditioned space by insulating interior surfaces to a minimum of R-11 and any exterior envelope surfaces per Chapter 13.~~)) Outside air ducts serving individual supply air units with less than 2,800 cfm of total supply air capacity shall be insulated to a minimum of R-7 and are not considered building envelope. Other outside air duct runs are considered building envelope until they,

1. connect to the heating or cooling equipment, or

2. are isolated from the exterior with an automatic shut-off damper complying with Section 1412.4.1.

Once outside air ducts meet the above listed requirements, any runs within conditioned space shall comply with Table 14-5 requirements.

Other ducts and plenums shall be thermally insulated per Table 14-5.

EXCEPTIONS: 1. Within the HVAC equipment.
2. Exhaust air ducts not subject to condensation.

3. Exposed ductwork within a zone that serves that zone.

1420 Simple Systems.

Discussion: Delete simple systems section to create consistent requirements for all system types.
Proposal: Amend 2006 WSEC as follows -

SECTION 1420 — SIMPLE SYSTEMS
(Packaged Unitary Equipment)

All systems shall comply with Sections 1430 through 1439.

((~~**1421 System Type:** To qualify as a simple system, systems shall be one of the following:~~
~~a. Air cooled, constant volume packaged equipment, which provide heating, cooling or both, and require only external connection to duct work and energy services.~~

~~b. Air cooled, constant volume split systems, which provide heating, cooling or both, with cooling capacity of 84,000 Btu/h or less.~~

~~c. Heating only systems which have a capacity of less than 5,000 cfm or which have a minimum outside air supply of less than 70% of the total air circulation.~~

~~All other systems shall comply with Sections 1430 through 1439.~~

~~**1422 Controls:** In addition to the control requirements in Section 1412, where separate heating and cooling equipment serve the same temperature zone, thermostats shall be interlocked to prevent simultaneous heating and cooling. Systems which provide heating and cooling simultaneously to a zone are prohibited.~~

~~**1423 Economizers:** Economizers meeting the requirements of Section 1413 shall be installed on:~~

~~a. cooling units installed outdoors or in a mechanical room adjacent to outdoors having a total cooling capacity greater than 20,000 Btu/h including those serving computer server rooms, electronic equipment, radio equipment, and telephone switchgear; and~~

~~b. other cooling units with a total cooling capacity greater than 54,000 Btu/h, including those serving computer server rooms, electronic equipment, radio equipment, and telephone switchgear.~~

~~EXCEPTION: For Group R Occupancy, economizers meeting the requirement of Section 1413 shall be installed on single package unitary fan cooling units having a total cooling capacity greater than 54,000Btu/h.~~

~~The total capacity of all units without economizers (i.e., those units with a total cooling capacity less than a and b above) shall not exceed 240,000 Btu/h per building, or 10% of its aggregate cooling (economizer) capacity, whichever is greater. That portion of the equipment serving Group R occupancy is not included in determining the total capacity of all units without economizers in a building.~~))

1431.2 System Sizing Limits.

Discussion: (1) No Seattle changes (retain existing Seattle amendment),
(2) Provide prescriptive sizing option in exception 4.

Proposal: Amend 2006 WSEC as follows -

1431.2 System Sizing Limits: Heating and cooling design loads for the purpose of sizing systems shall be determined in accordance with one of the procedures described in Chapter 30 of Standard RS-1 listed in Chapter 7, or an equivalent computation procedure. For interior temperatures, 70°F shall be used for heating and 75°F for cooling, except where different values are specified in the Washington Administrative Code (WAC). For exterior temperatures, 24°F shall be used for heating and 82°F drybulb and 66°F wetbulb for cooling.

Building mechanical systems for all buildings which provide space heating and/or space cooling shall be sized no greater than 150% of the design load as calculated above, except that cooling towers shall comply with the sizing requirements in Section 1411.1. No additional safety factor is allowed.

For buildings with a total equipment cooling capacity of 300 tons and above, the equipment shall comply with one of the following: (1) no one unit shall have a cooling capacity of more

than 2/3 of the total installed cooling equipment capacity; (2) the equipment shall have a variable speed drive; or (3) the equipment shall have multiple compressors.

EXCEPTIONS: The following limited exemptions from the sizing limit shall be allowed, however, in all cases heating and/or cooling design load calculations shall be submitted.

1. For a single piece of equipment which has both heating and cooling capability, only one function, either the heating or the cooling, need meet the requirements of this section. Capacity for the other function shall be, within available equipment options, the smallest size necessary to meet the load.

2. Stand-by equipment may be installed if controls and devices are provided which allow redundant equipment to operate automatically only when the primary equipment is not operating.

3. Multiple units of the same equipment type, such as multiple chillers and boilers, with combined capacities exceeding the design load, or a single unit that is capable of modulating to a part-load capacity of 50% of the load or less, may be specified to operate concurrently only if controls are provided that sequence or otherwise optimally control the operation of each unit based on load.

4. Installed space heating equipment output that does not exceed 14 Btu/h per square foot of gross conditioned floor area and installed space cooling equipment output that does not exceed 23 Btu/h per square foot of gross conditioned floor area. No additional safety factor is allowed.

1433 Economizers.

Discussion: (a) Exception 1: Retain existing Seattle amendment, but lower threshold to 27,000 Btuh, lower total capacity of all units without economizers, and add clarifying note.
(b) Exception 3: No Seattle changes (retain existing Seattle amendment).
(c) Exception 6: Limit exception to systems with dehumidification.
(d) Exception 7: No Seattle changes (retain existing Seattle amendment).
(e) Exception 9: No Seattle changes (retain existing Seattle amendment), but add clarifying note.

Proposal: Amend 2006 WSEC as follows -

1433 Economizers: Air economizers meeting the requirements of Section 1413 shall be provided on all new systems including those serving computer server rooms, electronic equipment, radio equipment, telephone switchgear**.**

EXCEPTIONS: 1. Qualifying small equipment: This exception shall not be used for unitary cooling equipment installed outdoors or in a mechanical room adjacent to the outdoors. This exception is allowed to be used for other cooling units and split systems with a total cooling capacity rated in accordance with 1411.2 of less than 33,000 Btu/h (hereafter referred to as qualifying small systems) provided that these are ((~~H~~))high-efficiency cooling ((~~units~~)) equipment with SEER and EER values more than ((~~10%~~)) 15% higher than minimum efficiencies listed in Tables 14-1A, 14-1B and 14-1D, in the appropriate size category, using the same test procedures. The total capacity of all ((~~systems~~)) qualifying small equipment without economizers shall not exceed ((~~480,000~~)) 72,000 Btu/h per building, or ((~~20%~~)) 5% of its air economizer capacity, whichever is greater. That portion of the equipment serving Group R Occupancy is not included in determining the total capacity of all units without economizers in a building. Redundant units are not counted in the capacity limitations. This exception shall not be used for RS-29 analysis((~~ nor include unitary cooling equipment installed outdoors nor in a mechanical room adjacent to outdoors~~)).

Note: Exception 1 is only applicable to HVAC equipment that complies with Section 1411.1 and is regulated in Tables 14-1A, 14-1B and 14-1D.

- Section 1411.1 requires that "If a nationally recognized certification program exists for a product covered in Tables 14-1A through 14-1G, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program." As the ARI program does satisfy those criteria, products subject to the ARI standards must be listed in the ARI Certification Program.

- In Tables 14-1A, 14-1B, and 14-1D, virtually all of the equipment efficiency ratings are required to be determined in accordance with an ARI standard. Energy Code compliance is determined at standard conditions (not at project specific conditions). Compliance should be verifiable through the ARI directory at www.aridirectory.org. It is not acceptable for a manufacturer to submit their own calculations for ARI standards.

- Consequently, to use Exception 1 to Section 1433, a product must both: be within the scope of the specified ARI standard and be included in the ARI certification program. Certain equipment used in computer server rooms is not within the scope of the standards listed in Tables 14-1A, 14-1B, and 14-1D and is not eligible for certification. Therefore, such equipment does not qualify to use Exception 1 to Section 1433 (though it may qualify to use another exception).

2. Chilled water terminal units connected to systems with chilled water generation equipment with ((~~COP and~~)) IPLV or NPLV values more than 10% higher than minimum efficiencies listed in Table 14-1C, 14-1K, 14-1L or 14-1M, in the appropriate size category, using the same test procedures. The total capacity of all systems without economizers shall not exceed ((~~480,000~~)) 72,000 Btu/h per building, or ((~~20%~~)) 5% of its air economizer capacity, whichever is greater. That portion of the equipment serving Group R Occupancy is not included in determining the total capacity of all units without economizers in a building. This exception shall not be used for RS-29 analysis.

3. ((~~Water-cooled refrigeration equipment provided with a water economizer meeting the requirements of Section 1413. Water economizer capacity per building shall not exceed 500 tons. This exception shall not be used for RS-29 analysis.~~)) Reserved.

4. Systems for which at least 75% of the annual energy used for mechanical cooling is provided from site-recovery or site-solar energy source.

5. Systems where special outside air filtration and treatment, for the reduction and treatment of unusual outdoor contaminants, makes an air economizer infeasible.

6. Systems with dehumidification that affect other systems (((~~such as dehumidification and supermarket refrigeration systems~~))) so as to increase the overall building energy consumption. New humidification equipment shall comply with Section 1413.4.

7. Systems complying with all of the following criteria:

a. Consist of multiple water source heat pumps with a total cooling capacity for each water-source heat pump of less than 54,000 Btu/h that are connected to a common water loop;

b. Have a minimum of 60% air economizer complying with Section 1413 that is ducted in a fully enclosed path directly to every heat pump unit in each zone, except that ducts may terminate within 12 inches of the intake to an HVAC unit provided that they are physically fastened so that the outside air duct is directed into the unit intake;

c. Have water source heat pumps with an EER at least 15% higher for cooling and, for units serving perimeter zones with heating loads (e.g. zones with exterior walls, roofs, or floors), a COP at least 15% higher for heating than that specified in Section 1411;

d. Where provided with a dedicated boiler or furnace for that building, have a central boiler or furnace efficiency of:

i. 90% minimum for units up to 199,000 Btu/h; and

ii. 85% minimum for units above 199,000 Btu/h input; and

e. Provide heat recovery with a minimum 50% heat recovery effectiveness as defined in Section 1436 to preheat the outside air supply.

8. For Group R Occupancy, cooling units installed outdoors or in a mechanical room adjacent to outdoors with a total cooling capacity less than 20,000 Btu/h and other cooling units with a total cooling capacity less than 54,000 Btu/h.

9. Equipment used to cool any dedicated server room, electronic equipment room or telecom switch room provided that they completely comply with option a or option b or option c or option d in the table below. This exception shall not be used for RS-29 analysis.

	Equipment Type	**Higher Equipment Efficiency**	**Part-load Control**	**Economizer**
Option 9a	Table 14-1A and Table 14-1B[a]	+ 15%[b]	Required over 85,000 Btu/h[c]	None required
Option 9b	Table 14-1A and Table 14-1B[a]	+ 5%[d]	Required over 85,000 Btu/h[c]	Waterside economizer[e]

	Equipment Type	**Higher Equipment Efficiency**	**Part-load Control**	**Economizer**
Option 9c	Table 14-1C, Table 14-1K, Table 14-1L, and Table 14-1M[f]	+ 5%/10%[g]	Required for all chillers[h]	Waterside economizer[e]
Option 9d	ASHRAE Standard 127[i]	+ 0%[j]	Required over 85,000 Btu/h[c]	Waterside economizer[e]

Notes to Exception 9.

a. For a system where all of cooling equipment is subject to the ARI standards listed in Table 14-1A and Table 14-1B, the system shall comply with all of the following (note that if the system contains any cooling equipment that exceeds the capacity limits in Table14-1A or Table 14-1B, or if the system contains any cooling equipment that is not included in Table14-1A or Table 14-1B, then system is not allowed to use this option).

b. The cooling equipment shall have an EER value and an IPLV value that is a minimum of 15% greater than the value listed in Table 14-1A and Table 14-1B (1.15 x values in Tables 14-1A and 14-1B).

c. For units with a total cooling capacity over 85,000 Btuh, the system shall utilize part-load capacity control schemes that are able to modulate to a part-load capacity of 50% of the load or less that results in the compressor operating at the same or higher EER at part loads than at full load (e.g. minimum of two-stages of compressor unloading such as cylinder unloading, two-stage scrolls, dual tandem scrolls, but hot gas bypass is not credited as a compressor unloading system).

d. The cooling equipment shall have an EER value and an IPLV value that is a minimum of 5% greater than the value listed in Table 14-1A and Table 14-1B (1.05 x values in Tables 14-1A and 14-1B).

e. The system shall include a water economizer in lieu of air economizer. Water economizers shall be capable of providing the total concurrent cooling load served by the connected terminal equipment lacking airside economizer, at outside air temperatures of 45°F dry-bulb/40°F wet-bulb and below. For this calculation, all factors including solar and internal load shall be the same as those used for peak load calculations, except for the outside temperatures. The equipment shall be served by a dedicated condenser water system unless a non-dedicated condenser water system exists that can provide appropriate water temperatures during hours when waterside economizer cooling is available.

f. For a system with chillers subject to the ARI standards listed in Table 14-1C, Table 14-1K, Table 14-1L, and Table 14-1M (e.g. a chilled water system with fan coil units).

g. For air-cooled chillers, the cooling equipment shall have an IPLV value that is a minimum of 5% greater than the IPLV value listed in Table 14-1C (1.05 x values in Table 14-1C). For water-cooled chillers, the cooling equipment shall have an IPLV or NPLV value that is a minimum of 10% greater than the IPLV or NPLV value listed in Table 14-1C, Table 14-1K, Table 14-1L, and Table 14-1M (1.10 x values in Table 14-1C, Table 14-1K, Table 14-1L, and Table 14-1M).

h. The chiller shall utilize part-load capacity control schemes that are able to modulate to a part-load capacity of 50% of the load or less that results in the compressor operating at the same or higher EER at part loads than at full load (e.g. minimum of two-stages of compressor unloading such as cylinder unloading, two-stage scrolls, dual tandem scrolls, but hot gas bypass is not credited as a compressor unloading system).

i. For a system where all of cooling equipment is subject to ASHRAE Standard 127-2001.

j. The cooling equipment subject to the ASHRAE Standard 127-2001 shall have an EER value and an IPLV value that is equal or greater than the value listed in Table 14-1A and Table 14-1B when determined in accordance with the rating conditions ASHRAE Standard 127-2001 (i.e. not the rating conditions in ARI Standard 210/240 or 340/360).

Note: Exception 9, options 9a and 9b are only applicable to HVAC equipment that complies with Section 1411.1 and is regulated in Tables 14-1A and 14-1B.

- Section 1411.1 requires that "If a nationally recognized certification program exists for a product covered in Tables 14-1A through 14-1G, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program." As the ARI program does satisfy those criteria, products subject to the ARI standards must be listed in the ARI Certification Program.

- In Tables 14-1A and 14-1B, virtually all of the equipment efficiency ratings are required to be determined in accordance with an ARI standard. Energy Code compliance is determined at standard conditions (not at project specific conditions). Compliance should be verifiable through the ARI directory at www.aridirectory.org. It is not acceptable for a manufacturer to submit their own calculations for ARI standards.

- Consequently, to use Exception 9 options 9a and 9b to Section 1433, a product must both: be within the scope of the specified ARI standard and be included in the ARI certification program. Certain equipment used in computer server rooms is not within the scope of the standards listed in Tables 14-1A and 14-1B and is not eligible for certification. Therefore, such equipment does not qualify to use Exception 9 options 9a and 9b to Section 1433.

- Certain equipment used in computer server rooms is not within the scope of the standards listed in Tables 14-1A and 14-1B, but is within the scope of ASHRAE Standard 127, *Method of Testing for Rating Computer and Data Processing Room Unitary Air Conditioners*. This equipment is eligible to use Exception 9 option 9d to Section 1433.

Note: For hydronic systems over 300,000 Btuh, see Section 1432.2.2.

1435 Simultaneous Heating and Cooling.

Discussion: No Seattle changes (retain existing Seattle amendment), but add clarification.
Proposal: Amend 2006 WSEC as follows -

1435 Simultaneous Heating and Cooling: Systems which provide heating and cooling simultaneously to a zone are prohibited. Zone thermostatic and humidistatic controls shall be capable of operating in sequence the supply of heating and cooling energy to the zone. Such controls shall prevent:

a. Reheating for temperature control.

b. Recooling for temperature control.

c. Mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by economizer systems or by mechanical refrigeration.

d. Other simultaneous operation of heating and cooling systems to the same zone.

e. Reheating for humidity control.

EXCEPTIONS: 1. Zones for which the volume of air that is reheated, recooled, or mixed is no greater than the larger of the following:

a. The volume of air required to meet the ventilation requirements of the ((~~Washington State Ventilation and Indoor Air Quality Code~~)) Seattle Mechanical Code for the zone.

b. 0.4 cfm/ft^2 of the zone conditioned floor area (before reheating), provided that the temperature of the primary system air is, by design or through reset controls, 0-12°F below the design space heating temperature when outside air temperatures are below 60°F for reheat systems and the cold deck of mixing systems and 0-12°F above design space temperature when outside air temperatures are above 60°F for recooling systems and the hot deck of mixing systems. For multiple zone systems, each zone need not comply with this exception provided the average of all zones served by the system that have both heating and cooling ability comply.

c. 300cfm. This exception is for zones whose peak flow rate totals no more than 10% of the total fan system flow rate.

d. Any higher rate that can be demonstrated, to the satisfaction of the building official, to reduce overall system annual energy usage by offsetting reheat/recool energy losses through a reduction in outdoor air intake in accordance with the multiple space requirements defined in ASHRAE Standard 62.

2. Zones where special pressurization relationships, cross-contamination requirements, or code-required minimum circulation rates are such that variable air volume systems are impractical.

3. Zones where at least 75% of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered (including condenser heat) or site solar energy source.

4. Zones where specific humidity levels are required to satisfy process needs, such as computer rooms, museums, surgical suites, and buildings with refrigerating systems, such as supermarkets, refrigerated warehoused and ice arenas.

1436 Energy Recovery.

Discussion: (1) No Seattle changes (retain existing Seattle amendment);
(2) Set thresholds for different outside air supply rates;
(3) Increase recovery effectiveness to 60%; and
(4) Specify energy recovery effectiveness temperature.

Proposal: Amend 2006 WSEC as follows -

1436 Heat Recovery

1436.1 Fan Systems: Fan systems which

a. have both (1) a capacity of 5,000 cfm or greater or serve a space with a design heating or cooling load exceeding 150 Btu/h-ft^2 and (2) which have a minimum outside air supply of 70% or greater of the total air circulation, or

b. have both (1) a capacity of 10,000 cfm or greater and (2) which have a minimum outside air supply of 50% or greater of the total air circulation, or

c. have both (1) a capacity of 20,000 cfm or greater and (2) which have a minimum outside air supply of 30% or greater of the total air circulation,

shall have a heat recovery system with at least 50% recovery effectiveness. Fifty percent heat recovery effectiveness shall mean an increase in the outside air supply temperature at design heating conditions of one-half the difference between the outdoor design air temperature and 65°F (44.5°F in Seattle). Provisions shall be made to bypass or control the heat recovery system to permit air economizer operation as required by Section 1433. Heat recovery may be provided from any site-recovered or site-solar source.

EXCEPTIONS: These exceptions only apply to the particular exhaust subsystems. The remaining cfm of the main supply system is subject to the energy recovery requirements.

1. Laboratory systems equipped with both variable air volume supply and variable air volume or two-speed exhaust fume hoods provided that an instruction label is placed on the face of the hood that provides the information in Exhibit 14-1.

Exhibit 14-1

INSTRUCTIONS TO OPERATOR

To be in compliance with the Seattle Energy Code, this fume hood is designed to operate as variable air volume (VAV) by adjusting the sash or controller. Maintain sash in the minimum position during use and close totally when the fume hood is not in use.

2. Systems serving spaces heated to less than 60°F.

3. Systems which can be shown to use as much energy with the addition of heat recovery equipment as without it.

4. Systems exhausting toxic, flammable, paint exhaust or corrosive fumes making the installation of heat recovery equipment impractical.

5. Type I commercial kitchen hoods.

1436.2 Condensate Systems: On-site steam heating systems shall have condensate water recovery. On-site includes system that is located within or adjacent to one or more buildings within the boundary of a contiguous area or campus under one ownership and which serves one or more of those buildings.

Other buildings with steam heating systems which do not have condensate water recovery shall have condensate heat recovery.

1436.3 Energy Recovery for Service Water Heating: Condenser heat recovery systems shall be installed for heating or preheating of service hot water provided all of the following are true:

a. The facility operates 24 hours a day.

b. The total installed heat rejection capacity of the water-cooled systems exceeds 6,000,000 Btu/h of heat rejection.

c. The capacity of service water heating equipment exceeds 1,000,000 Btu/h.

The required energy recovery system shall have the capacity to provide the smaller of:

a. 60% of the peak heat rejection load at design conditions, or

b. preheat of the peak service hot water draw to 85°F, or

c. 50% of the service water heating load.

EXCEPTIONS: 1. Facilities that employ condenser heat recovery for space heating with a heat recovery design exceeding 30% of the peak water-cooled condenser load at design conditions.

2. Facilities that provide 60% of their service water heating from site solar or site recovered energy or from other sources.

1437 Electric Motor Efficiency.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1437 Electric Motor Efficiency: Design A & B squirrel-cage. T-frame induction permanently wired polyphase motors of 1 hp or more having synchronous speeds of 3,600, 1,800 and 1,200 rpm shall have a nominal full-load motor efficiency no less than the corresponding values for energy efficient motors provided in Table 14-4.

EXCEPTIONS: 1. Motors used in systems designed to use more than one speed of a multi-speed motor.

2. Motors used as a component of the equipment meeting the minimum equipment efficiency requirements of Section 1411 and Tables 14-1A through 14-1G provided that the motor input is included when determining the equipment efficiency.

3. Motors that are an integral part of specialized process equipment.

4. Where the motor is integral to a listed piece of equipment for which no complying motor has been approved**.**

Fan motors less than 1 hp in series terminal units shall

a. be electronically-commutated motors, or

b. have a minimum motor efficiency of 65% when rated in accordance with NEMA Standard MG-1 at full load rating conditions.

1438 Variable Load Systems and System Criteria.

Discussion: (1) Set threshold at 7.5 hp;
(2) Require variable speed control for all large fans and pumps (in lieu of adopting limits for overall fan system power, energy saved as a balancing device).

Proposal: Amend 2006 WSEC as follows -

1438 ((~~Variable Flow Systems and~~)) System Criteria for All Fans and Pumps: For fans and pumps 7.5 hp and greater ((~~ than 10 hp, where the application involves variable flow, and water source heat pump loops subject to the requirements of Section 1432.2.2~~)), there shall be:

a. Variable speed drives, or

b. Other controls and devices that will result in fan and pump motor demand of no more than 30% of design wattage at 50% of design air volume for fans when static pressure set point equals 1/3 the total design static pressure, and 50% of design water flow for pumps, based on manufacturer's certified test data. Variable inlet vanes, throttling valves (dampers), scroll dampers or bypass circuits shall not be allowed.

At the time this code was adopted, very few technologies could be shown to meet the criteria in option b.

EXCEPTIONS: Variable speed devices are not required for motors 7.5 hp and greater that serve:

1. Fans or pumps in packaged equipment where variable speed devices are not available as a factory option from the equipment manufacturer.

2. Fans or pumps that are required to operate only for emergency fire-life-safety events (e.g. stairwell pressurization fans, elevator pressurization fans, fire pumps, etc.).

Static pressure sensors used to control variable air volume fans shall be placed in a position such that the controller set point is no greater than 1/3 the total design fan static pressure.

For systems with direct digital control of individual zone boxes reporting to the central control panel, there shall be static pressure reset controls and the static pressure set point shall be reset based on the zone requiring the most pressure; i.e., the set point is reset lower until one zone damper is nearly wide open.

1438.1 Cooling Towers: All cooling towers with a total fan motor horsepower 7.5 hp and greater ((~~than 10 hp~~)) shall be equipped with a variable speed drive or with a pony motor of a rated hp no greater than 1/3 of the hp of the primary motor. For pony motors, the cooling tower control shall provide two-stage operation of fans and shall bring the pony motor to operate without the primary motor while meeting the condenser water setpoint.

1440 Service Water Heating.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

SECTION 1440 — SERVICE WATER HEATING

Service water heating equipment shall comply with the applicable efficiencies in Tables 14-1A through 14-1M.

Effective January 1, 2004, commercial clothes washers installed in Seattle shall have a minimum modified energy factor (MEF) of 1.26. The MEF definition and test procedure set forth at 10 C.F.R. Part 430 (Energy Conservation Program for Consumer Products), as amended, is incorporated into this section by reference. Commercial clothes washers are defined as all clothes washers

a. installed for use on a fee basis, e.g. coin- or card-operated;

b. not covered by federal residential clothes washer efficiency standards; and

c. having a capacity of 20 lbs. or less.

1452 Pool Water Heaters.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1452 Pool Water Heaters: Pool water heaters using electric resistance heating as the primary source of heat are prohibited for pools over 2,000 gallons. Heat pump pool heaters shall have a minimum COP of 4.0 determined in accordance with ASHRAE Standard 146, Method of Testing for Rating Pool Heaters. Other pool heating equipment shall comply with the applicable efficiencies in Tables 141A through ((~~14-1G~~)) 14-1M.

1454 Pool Covers and Insulation**.**

Discussion: Require the side and bottom surfaces of spas to be insulated.
Proposal: Amend 2006 WSEC as follows -

1454 Pool Covers and Insulation: Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F shall have a pool cover with a minimum insulation value of R-12, and the sides and bottom of the pool shall also have a minimum insulation value of R-12.

Table 14-1C and companion Tables 14-1K, 14-1L, 14-1M

Discussion: Provide higher minimum part-load efficiencies for chillers, corresponding changes to companion Tables 14-1K, 14-1L, 14-1M.

Proposal: Amend 2006 WSEC as follows -

TABLE 14-1C
WATER CHILLING PACKAGES, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	~~((Sub-Category or Rating Condition))~~ Maximum kW/ton[d]	Minimum Efficiency	Test Procedure
Air Cooled, With Condenser, Electrically Operated	All Capacities	1.26 0.95	2.80 COP ((~~3.05~~))3.70 IPLV	ARI 550/590
Air Cooled, Without Condenser, Electrically Operated	All Capacities	1.13 0.85	3.10 COP ((~~3.45~~))4.15 IPLV	
Water Cooled, Electrically Operated	< 40 tons	0.84 0.63	4.20 COP 5.55 IPLV	ARI 550/590
	> 40 tons and < 150 Tons	0.79 0.61	4.45 COP 5.80 IPLV	
	≥150 Tons and < 300 Tons	0.63 0.54	5.55 COP[c] 6.50 IPLV	
	≥300 Tons	0.58 0.50	6.10 COP[c] 7.05 IPLV	
((~~Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)~~))	((~~All Capacities~~))		((~~4.20 COP~~)) ((~~5.05 IPLV~~))	((~~ARI 550/590~~))
((~~Water Cooled, Electrically Operated, Positive Displacement (Rotary Screw and Scroll)~~))	((~~<150 Tons~~))		((~~4.45 COP 5.05 IPLV~~))	((~~ARI 550/590~~))
	((~~≥150 Tons and <300 Tons~~))		((~~4.90 COP 5.60 IPLV~~))	
	((~~≥300 Tons~~))		((~~5.50 COP 6.15 IPLV~~))	
((~~Water Cooled, Electrically Operated, Positive Displacement (Centrifugal)~~))	((~~<150 Tons~~))		((~~5.00 COP 5.25 IPLV~~))	((~~ARI 550/590~~))
	((~~≥150 Tons and <300 Tons~~))		((~~5.55 COP 5.90 IPLV~~))	
	((~~≥300 Tons~~))		((~~6.10 COP 6.40 IPLV~~))	
Air Cooled Absorption Single Effect	All Capacities		0.60 COP	ARI 560
Water Cooled Absorption Single Effect	All Capacities		0.70 COP	ARI 560
Absorption Double Effect, Indirect-Fired	All Capacities		1.00 COP 1.05 IPLV	ARI 560
Absorption Double Effect, Direct-Fired	All Capacities		1.00 COP 1.00 IPLV	ARI 560

[a] Reserved.

[b] The chiller equipment requirements do not apply for chillers used in low temperature applications where the design leaving fluid temperature is less than or equal to 40°F.

[c] COP requirements do not apply to other than centrifugal equipment.

[d] This column is inserted for the convenience of users. The values are converted from the COP and IPVL values in the following column using the equation: kW/ton=1/(COP x 3413/12000).

TABLE 14-1K
IPLV/NPLV FOR CENTRIFUGAL CHILLERS < 150 TONS

Water Cooled Chillers < 150 Tons $IPLV_{std}$ = 5.80								
			Condenser Flow Rate					
			2 gpm/ton[d]	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT[a] (°F)	Required IPLV/NPLV					
46	75	29	6.42	6.71	6.93	7.27	7.52	7.70
45	75	30	6.33	6.60	6.81	7.12	7.35	7.51
44	75	31	6.24	6.50	6.69	6.97	7.18	7.34
43	75	32	6.15	6.40	6.59	6.85	7.03	7.17
42	75	33	6.06	6.31	6.49	6.73	6.90	7.03
41	75	34	5.97	6.23	6.39	6.62	6.78	6.89
46	80	34	5.97	6.23	6.39	6.62	6.78	6.89
40	75	35	5.89	6.14	6.30	6.52	6.67	6.77
45	80	35	5.89	6.14	6.30	6.52	6.67	6.77
44	80	36	5.79	6.05	6.22	6.42	6.56	6.67
43	80	37	5.68	5.96	6.13	6.34	6.46	6.56
42	80	38	5.57	5.86	6.04	6.24	6.37	6.46
41	80	39	5.45	5.76	5.95	6.16	6.28	6.36
46	85	39	5.45	5.76	5.95	6.16	6.28	6.36
40	80	40	5.31	5.65	5.85	6.07	6.19	6.27
45	85	40	5.31	5.65	5.85	6.07	6.19	6.27
44	85	41	5.16	5.54	**5.80**[c]	5.97	6.11	6.18
43	85	42	5.01	5.42	5.64	5.89	6.02	6.09
42	85	43	4.82	5.28	5.53	5.79	5.92	6.01
41	85	44	4.63	5.14	5.40	5.69	5.83	5.92
40	85	45	4.41	4.97	5.27	5.57	5.72	5.82
Condenser DT[b]			14.04	11.23	9.36	7.02	5.62	4.68

[a] LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
[b] Condenser DT = Leaving Condenser Water Temperature (F) – Entering Condenser Water Temperature (F)
[c] All values shown are NPLV except at conditions of 3 gpm/ton and 41 F LIFT which is IPLV.
[d] Retrofit applications only.

TABLE 14-1L
IPLV/NPLV FOR CENTRIFUGAL CHILLERS
> 150 TONS, < 300 TONS

Water Cooled Chillers > 150 Tons, < 300 Tons $IPLV_{std}$ = 6.50								
			Condenser Flow Rate					
			2 gpm/ton[d]	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT[a] (°F)	Required IPLV/NPLV					
46	75	29	7.24	7.56	7.82	8.21	8.48	8.69
45	75	30	7.14	7.44	7.68	8.03	8.28	8.47
44	75	31	7.04	7.33	7.55	7.87	8.10	8.27
43	75	32	6.94	7.22	7.43	7.72	7.93	8.09
42	75	33	6.84	7.12	7.32	7.59	7.78	7.92
41	75	34	6.74	7.02	7.21	7.47	7.65	7.77
46	80	34	6.74	7.02	7.21	7.47	7.65	7.77
40	75	35	6.63	6.92	7.11	7.35	7.51	7.63
45	80	35	6.63	6.92	7.11	7.35	7.51	7.63
44	80	36	6.52	6.82	7.01	7.24	7.39	7.50
43	80	37	6.40	6.72	6.91	7.14	7.28	7.39
42	80	38	6.28	6.61	6.81	7.04	7.18	7.28
41	80	39	6.14	6.50	6.71	6.94	7.08	7.17
46	85	39	6.14	6.50	6.71	6.94	7.08	7.17
40	80	40	5.98	6.38	6.60	6.84	6.99	7.07
45	85	40	5.98	6.38	6.60	6.84	6.99	7.07
44	85	41	5.82	6.25	**6.50[c]**	6.74	6.89	6.97
43	85	42	5.64	6.11	6.37	6.63	6.78	6.88
42	85	43	5.43	5.95	6.24	6.52	6.68	6.78
41	85	44	5.21	5.79	6.09	6.40	6.57	6.68
40	85	45	4.97	5.60	5.94	6.28	6.46	6.57
Condenser DT[b]			14.04	11.23	9.36	7.02	5.62	4.68

[a] LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
[b] Condenser DT = Leaving Condenser Water Temperature (F) – Entering Condenser Water Temperature (F)
[c] All values shown are NPLV except at conditions of 3 gpm/ton and 41 F LIFT which is IPLV.
[d] Retrofit applications only.

TABLE 14-1M
IPLV/NPLV FOR CENTRIFUGAL CHILLERS > 300 TONS

Water Cooled Chillers > 300 Tons $IPLV_{std}$ = 7.05								
			Condenser Flow Rate					
			2 gpm/ton[d]	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT[a] (°F)	Required IPLV/NPLV					
46	75	29	7.87	8.22	8.49	8.91	9.21	9.44
45	75	30	7.76	8.09	8.34	8.72	9.00	9.20
44	75	31	7.65	7.95	8.20	8.55	8.80	8.98
43	75	32	7.54	7.84	8.06	8.39	8.61	8.78
42	75	33	7.43	7.73	7.94	8.24	8.45	8.60
41	75	34	7.32	7.62	7.83	8.11	8.31	8.44
46	80	34	7.32	7.62	7.83	8.11	8.31	8.44
40	75	35	7.21	7.51	7.71	7.99	8.16	8.29
45	80	35	7.21	7.51	7.71	7.99	8.16	8.29
44	80	36	7.08	7.40	7.61	7.87	8.03	8.15
43	80	37	6.95	7.29	7.50	7.76	7.91	8.03
42	80	38	6.82	7.18	7.39	7.65	7.80	7.91
41	80	39	6.67	7.06	7.28	7.54	7.69	7.79
46	85	39	6.67	7.06	7.28	7.54	7.69	7.79
40	80	40	6.50	6.93	7.17	7.44	7.58	7.68
45	85	40	6.50	6.93	7.17	7.44	7.58	7.68
44	85	41	6.33	6.79	**7.05**[c]	7.33	7.47	7.58
43	85	42	6.13	6.63	6.91	7.21	7.37	7.47
42	85	43	5.91	6.47	6.78	7.08	7.25	7.36
41	85	44	5.67	6.28	6.61	6.96	7.14	7.25
40	85	45	5.40	6.08	6.45	6.82	7.01	7.13
Condenser DT[b]			14.04	11.23	9.36	7.02	5.62	4.68

[a] LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
[b] Condenser DT = Leaving Condenser Water Temperature (F) – Entering Condenser Water Temperature (F)
[c] All values shown are NPLV except at conditions of 3 gpm/ton and 41 F LIFT which is IPLV.
[d] Retrofit applications only.

Table 14-1G Performance Requirements for Heat Rejection Equipment.

Discussion: Clarify application.
Proposal: Amend 2006 WSEC as follows -

TABLE 14-1G
PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Sub-Category or Rating Condition	Minimum Efficiency[b]	Test Procedure[c]
Propeller or Axial Fan Cooling Towers	All	95°F (35°C) Entering Water 85°F (29°C) Leaving Water 75°F (24°C) wb Outdoor Air	≥38.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal Fan Cooling Towers	All	95°F (35°C) Entering Water 85°F (29°C) Leaving Water 75°F (24°C) wb Outdoor Air	≥ 20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Air Cooled Condensers	All	125°F (52°C) Condensing Temperature R22 Test Fluid 190°F (88°C) Entering Gas Temperature 15°F (8°C) Subcooling 95°F (35°C) Entering Drybulb	≥176,000 Btu/h·hp	ARI 460

[a] For purposes of this table, cooling tower performance is defined as the maximum flow rating of the tower divided by the fan nameplate rated motor power.
[b] For purposes of this table air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power. Note that the gpm/hp criteria in Table 14-1G does not apply to water- or evaporatively-cooled closed-circuit cooling towers.
[c] Reserved.

1512 Exempt Lighting.

Discussion: (a) No Seattle changes (retain existing Seattle amendment);
(b) Clarify application to furniture-mounted task lighting per IESNA Standard 90.1-2004 addendum m.

Proposal: Amend 2006 WSEC as follows -

1512 Exempt Lighting: The use of these exemptions is at the applicant's option.

1512.1 Exempt Spaces: The following rooms, spaces and areas, are exempt from the ((~~lighting power~~)) requirements in Sections 1520 through 1522 and 1530 through 1532 but shall comply with all other requirements of this chapter:

1. ((~~Areas in which medical or dental tasks are performed.~~)) Reserved.
2. High risk security areas or any area identified by building officials as requiring additional lighting.
3. Spaces designed for primary use by the visually impaired((~~,~~)) or hard of hearing (lip-reading) ((~~or by senior citizens~~)).
4. ((~~Food preparation areas.~~)) Reserved.
5. Electrical/mechanical equipment rooms.
6. ((~~Inspection and restoration areas in galleries and museums.~~)) Reserved.
7. The sanctuary portion of a house of worship, defined as the space or room where the worship service takes place. Classrooms, meeting rooms, offices and multipurpose rooms that are part of the same facility are not exempt.

1512.2 Exempt Lighting Equipment: The following lighting equipment and tasks are exempt from the lighting requirements of Section 1520 through 1522 and need not be included when calculating the installed lighting power under Section 1530 through 1532 but shall comply with all other requirements of this chapter. All other lighting in areas that are not exempted by Section 1512.2, where exempt tasks and equipment are used, shall comply with all of the requirements of this chapter.

1. Special lighting needs for research.
2. Emergency lighting that is automatically OFF during normal building operation.
3. Lighting that is part of machines, equipment (⇦ niture.
4. Lighting that is used solely for indoor plant growth during the hours of 10:00 p.m. to 6:00 a.m. However, such lighting shall not be exempt unless it is in addition to general area lighting, is located in a separate fixture, and is controlled by an independent control device.
5. Lighting for theatrical productions, television broadcasting (including sports facilities), ((~~audio-visual presentations~~)) and special effects lighting for stage areas and dance floors in entertainment facilities. However, such lighting shall not be exempt unless it is in addition to general area lighting, is located in a separate fixture, and is controlled by an independent control device.
6. Lighting in galleries, museums and in main building entry lobbies for ((~~art~~)) exhibits, ((~~non-retail displays, portable plug in display fixtures and show case lighting~~)) inspection, and restoration. However, such lighting shall not be exempt unless it is in addition to general area lighting, is located in a separate fixture, and is controlled by an independent control device.
7. Lighting specifically designed for use only during medical or dental procedures and lighting integral to medical equipment. However, such lighting shall not be exempt unless it is in

addition to general area lighting, designed specifically for medical lighting, and is controlled by an independent control device.

8. Lighting integral to or specifically for food warming and food preparation equipment. However, such lighting shall not be exempt unless it is in addition to general area lighting, is located in a separate fixture, and is controlled by an independent control device.

9. Audio-visual and video-conferencing lighting with multi-level or dimming controls in rooms with permanently installed audio-visual equipment or video-conferencing equipment.

10. Permanently-installed undershelf or undercabinet lighting that has an automatic shutoff control device integral to or is directly attached to the luminaires or is automatically controlled by a wall-mounted control device that turns off the lighting whenever that particular space is unoccupied. Other permanently-installed undershelf or undercabinet lighting that is not automatically controlled are not exempt and shall be included when determining compliance with the lighting requirements of Section 1520 through 1522 and Section 1530 through 1532.

1513.1 Local Control and Accessibility.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1513.1 Local Control and Accessibility: Each space, enclosed by walls or ceiling-height partitions, shall be provided with lighting controls located within that space. The lighting controls, whether one or more, shall be capable of turning off all lights within the space. The controls shall be readily accessible, at the point of entry/exit, to personnel occupying or using the space.

EXCEPTIONS: The following lighting controls may be centralized in remote locations:

1. Lighting controls for spaces which must be used as a whole.
2. Automatic controls, when provided in addition to manual controls, need not be accessible to the users and may be centralized in a remote location.
3. Controls requiring trained operators.
4. Controls for safety hazards and security.

1513.3 Daylight Zone Controls.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1513.3 Daylight Zone Control: Lighting in ((~~A~~)) all daylighted zones, as defined in Chapter 2 (see Exhibits 1513.3a and 1513.3b), both under overhead glazing and adjacent to vertical glazing, shall be provided with controls that comply with Sections 1513.3.1 and 1513.3.2 ((~~individual controls, or daylight or occupant sensing automatic controls, which control the lights independent of general lighting~~)).

1513.3.1 Separate Control: Daylight zones shall have controls which control the lights independent of general area lighting.

Contiguous daylight zones adjacent to vertical glazing are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e. north, east, south, west). Daylight zones under overhead glazing more than 15 feet from the perimeter shall be controlled separately from daylight zones

adjacent to vertical glazing. For daylight zones under overhead glazing that exceed 5,000 square feet, there must be at least two independent photocontrol systems with each system having a dedicated photosensor.

EXCEPTION: Daylight spaces enclosed by walls or ceiling height partitions and containing 2 or fewer light fixtures are not required to have a separate switch for general area lighting.

1513.3.2 Automatic Control: Daylight zones shall have controls which automatically reduce lighting power in response to available daylight by either:

a. a combination of dimming ballasts and daylight-sensing automatic controls, which are capable of dimming the lights continuously, or

b. a combination of stepped switching and daylight-sensing automatic controls, which are capable of incrementally reducing the light level in steps automatically and turning the lights off automatically.

i. Single-lamp luminaire systems shall have three levels of automatic control: all lamps on, approximately half of the luminaires turned off in a relatively uniform pattern, and then all of the luminaires off. As an alternate, where the daylight zone contains two rows of luminaires and they are parallel to a window, three levels of automatic control may also be achieved by having both rows on, the row closest to the window off and the other row on, and both rows off. For rooms, such as small offices, which contain only a single one-lamp luminaire, it is acceptable for the daylighting control system to automatically switch off the entire luminaire.

ii. Two-lamp luminaires shall have three levels of automatic control: both lamps on, one lamp on and one lamp off, and both lamps off. As an alternate, where the daylight zone contains two rows of luminaires and they are parallel to a window, three levels of automatic control may also be achieved by having both rows on, the row closest to the window off and the other row on, and both rows off. For rooms, such as small offices, which contain only a single two-lamp luminaire, it is acceptable for the daylighting control system to automatically switch off the entire luminaire rather than switching off one lamp, then both lamps.

iii. Three-lamp luminaires shall have four levels of automatic control: all three lamps on, two lamps on and one lamp off, one lamp on and two lamps off, and all three lamps off.

iv. For other multi-lamp luminaries with four or more lamps, the number of required incremental steps shall be equal to one plus the number of lamps in the luminaire.

Any switching devices installed to override the automatic daylighting control shall comply with the criteria in Section 1513.6.2a-e.

EXCEPTIONS: 1. The following are exempt from the requirements for automatic daylighting controls in Section 1513.3.2:

a. retail spaces adjacent to vertical glazing (retail spaces under overhead glazing are not exempt),

b. lighting exempted by Section 1512, and

c. display, exhibition, and specialty lighting complying with Section 1513.4.

2. The following spaces are exempt from the requirements for automatic daylighting controls in Section 1513.3.2 provided that they have occupancy sensor controls that comply with Section 1513.6.1:

a. small spaces in the daylight zone that are normally unoccupied (such as a storage room with a window, or restrooms),

b. rooms less than 300 square feet, and

c. conference rooms 300 square feet and larger that have a lighting control system with at least four scene options.

3. HID lamps with automatic controls that are capable of reducing the power consumption by at least 50% in lieu of continuous dimming controls in 1513.3.2.

4. HID lamps 150 watts or less are exempt from the dimming requirements in 1513.3.2.

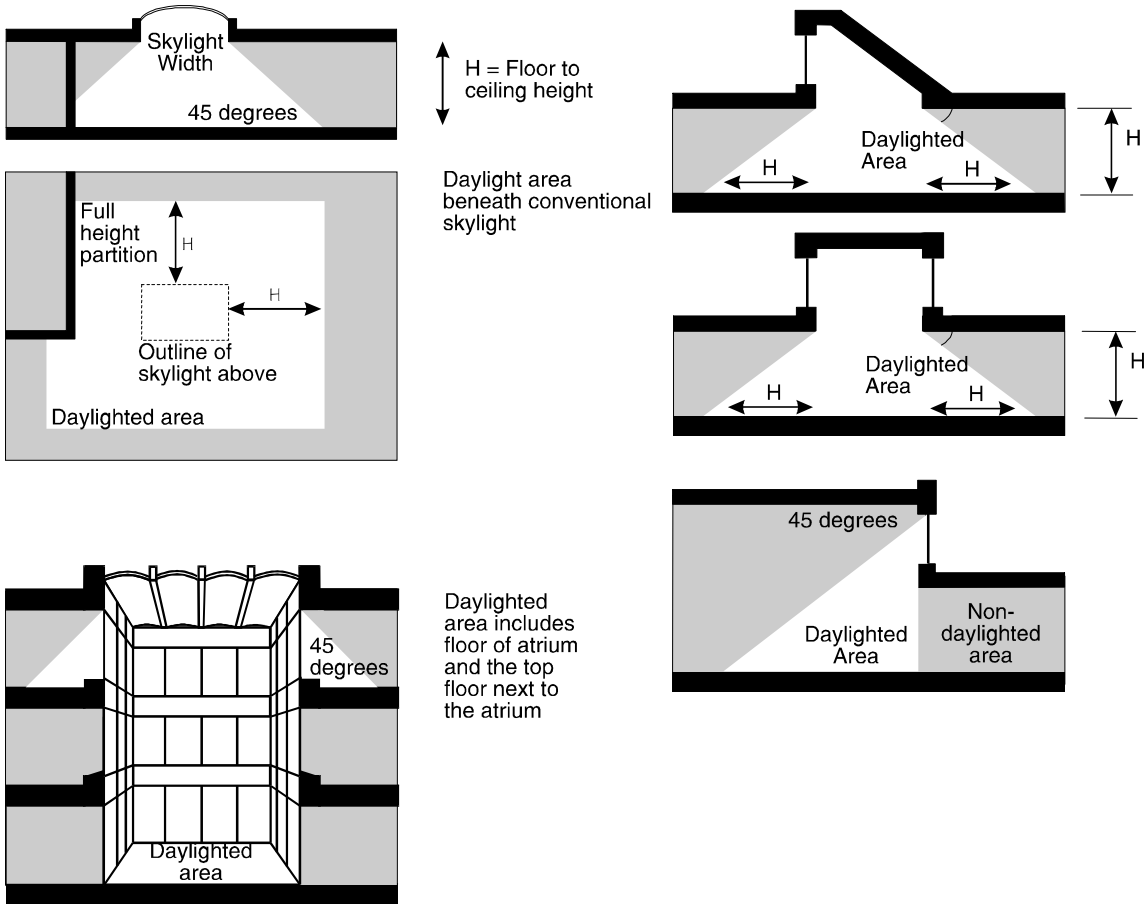

Exhibit 1513.3a

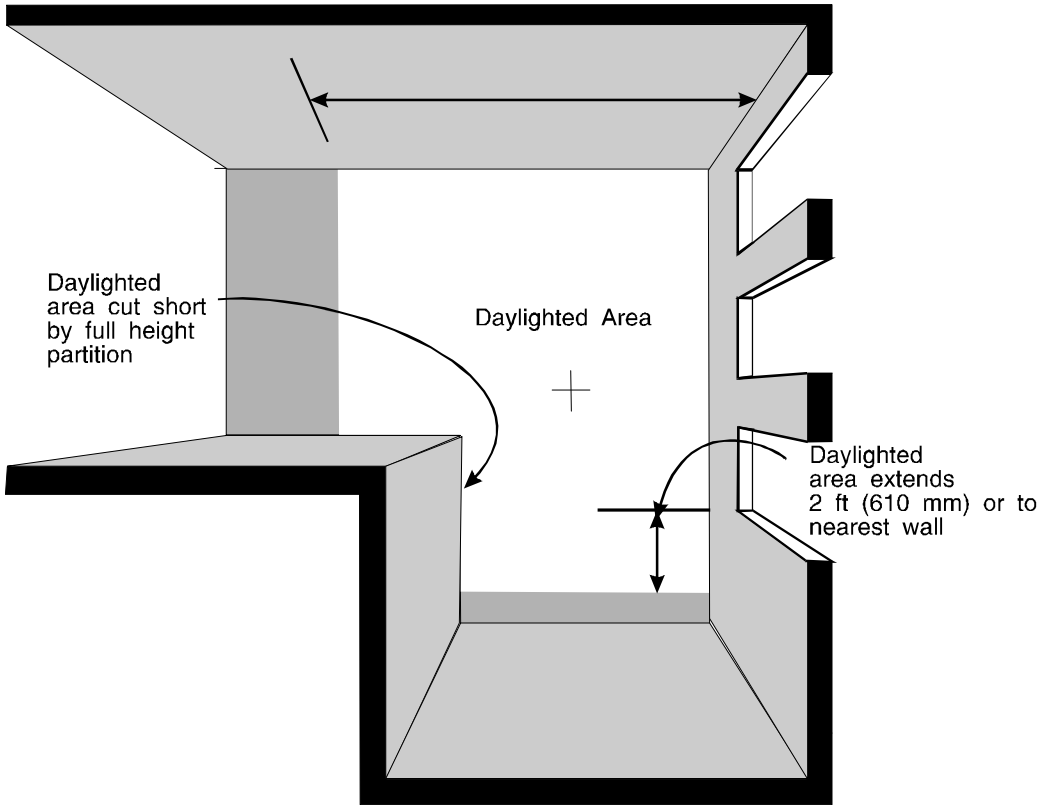

Exhibit 1513.3b

1532 Exterior Lighting Power Allowance.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

1532 Exterior Lighting Power Allowance: The exterior lighting power allowance shall be calculated separately for (1) covered parking, and (2) outdoor parking, outdoor areas and building exteriors. The lighting in these two areas shall not be traded.

The lighting allowance for covered parking shall be 0.20 W/ft^2, and the allowance for open parking and outdoor areas shall be 0.15 W/ft^2. For open parking and outdoor areas and roadways, luminaires mounted above 15 feet shall meet IESNA requirements for Full Cutoff Luminaires. (Full Cutoff means a luminaire light distribution where zero candela intensity occurs at an angle of 90 degrees above nadir, and all greater angles from nadir.)

The lighting allowance for building exteriors and externally-illuminated signs (including billboards) shall be calculated either by multiplying the building facade area that is illuminated or sign area by 0.15 W/ft^2 or multiplying the building perimeter in feet by 7.5 watts per lineal foot. Any building exterior lighting that exceeds 7.5 watts per square foot of total building perimeter is not allowed to be traded with other lighting areas.

EXCEPTIONS: 1. Group U occupancy accessory to Group R-3 or R-4 occupancy.

2. The top level of a parking garage is allowed to be included with the covered parking garage category provided that the luminaires on the top level meet the IESNA requirements for Full Cutoff Luminaires.

3. For the gas station pump area under canopy only, 1.00 W/ft^2 may be used. For automobile sales area only, and for other exterior retail sales, including but not limited to gardening supplies, 0.50 W/ft^2 may be used.

INFORMATIVE GUIDE TO SECTION 1532: NOTE THAT THIS GUIDE DOES NOT SUPERCEDE THE REQUIREMENTS IN THE TEXT.		
CATEGORY	**LIGHTING POWER ALLOWANCE**	**TRADEOFF LIMITATIONS**
PARKING AND OUTDOOR AREAS		
Covered Parking	0.20 Watts/square foot	Calculated separately. Trade offs not allowed with other categories.
Open parking and outdoor areas	0.15 Watts/square foot of area that is illuminated	Calculated separately, but see allowance below for use of façade lighting credit
FAÇADE LIGHTING		
Perimeter option	7.5 Watts/lineal foot of building perimeter	Calculated separately, but any wattage allowance not used for façade lighting may be used for open parking and outdoor areas that are illuminated
Surface area option	0.15 Watts/square foot of wall surface area that is illuminated	Calculated separately, but any wattage allowance up to 7.5 Watts/lineal foot of building perimeter that is not used for façade lighting may be used for open parking and outdoor areas that are illuminated

((All exterior building grounds luminaires that operate at greater than 100 watts shall contain lamps having a minimum efficacy of 60 lm/W unless the luminaire is controlled by a motion sensor or qualifies for one of the following exceptions.

The total exterior lighting power allowance for all exterior building applications is the sum of the individual lighting power densities permitted in Table 15-2 for these applications. Trade-offs are allowed only among exterior lighting applications listed in the Table 15-2 "Tradable Surfaces" section.

EXCEPTION: Lighting used for the following exterior applications is exempt when equipped with a control device independent of the control of the nonexempt lighting:

a. Specialized signal, directional, and marker lighting associated with transportation.
b. Lighting integral to signs.
c. Lighting integral to equipment or instrumentation and installed by its manufacturer.
d. Lighting for theatrical purposes, including performance, stage, film production, and video production.
e. Lighting for athletic playing areas.
f. Temporary lighting.
g. Lighting for industrial production.
h. Theme elements in theme/amusement parks.
i. Lighting used to highlight features of public monuments.
j. Group U Occupancy accessory to Group R-3 or R-4 Occupancy.

TABLE 15-2
LIGHTING POWER DENSITIES FOR BUILDING EXTERIORS

Tradable Surfaces (Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas may be traded.)	Uncovered Parking Areas	
	Parking Lots and drives	0.15 W/ft^2
	Building Grounds	
	Walkways less than 10 feet wide	1.0 W/linear foot
	Walkways 10 feet wide or greater Plaza areas Special Feature Areas	0.2W/ft^2
	Stairways	1.0 W/ft^2
	Building Entrances and Exits	
	Main entries	30 W/linear foot of door width
	Other doors	20 W/linear foot of door width
	Canopies and Overhangs	
	Canopies (free standing and attached and overhangs)	1.25 W/ft^2
	Outdoor Sales	
	Open areas (including vehicle sales lots)	0.5 W/ft^2
	Street frontage for vehicle sales lots in addition to "open area" allowance	20 W/linear foot
Non-Tradable Surfaces (Lighting power density calculations for the following applications can be used only for the specific application and can not be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the "tradable Surfaces" section of this	Building Facades	0.2 W/ft^2 for each illuminated wall or surface or 5.0W/linear foot for each illuminated wall or surface length
	Automated teller machines and night depositories	270 W per location plus 90 W per additional ATM per location
	Entrances and gatehouse inspection stations at guarded facilities	1.25 W/ft^2 of uncovered area (covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")
	Loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.5 W/ft^2 of uncovered area (covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")

~~table.)~~	~~Material handling and associated storage~~	~~0.5 W/ft^2~~
	~~Drive-up windows at fast food restaurants~~	~~400W per drive-through~~
	~~Parking near 24-hour retail entrances~~	~~800 W per main entry~~

))

Table 15-1 Unit Lighting Power Allowance.

Discussion: Revise lighting power allowances to achieve greater energy efficiency for office and retail spaces. While the 2006 WSEC required improvements in lighting efficiency for a number of space uses, two notable omissions were office and retail.

The lighting power allowance for office space was last revised in Seattle in 2001. Lamp technology has improved. While the first generation of T-8 fluorescent lamps achieved 75+ lumens per Watt, the second achieved 85+ lumens per Watt, and a third generation is now available that achieves 95+ lumens per Watt. The lighting power allowance for offices is 0.9 W/ft^2 in the Advanced Energy Design Guide (AEDG) developed by AIA, ASHRAE, IES, NBI (New Buildings Institute), the USDOE (U.S. Department of Energy), and the USGBC (U.S. Green Building Council).

Similarly, the lighting power allowance for retail space was last revised Statewide in 2000. Here again, lamp technology has improved. Fluorescent lamps have better color rendition and ceramic metal halide lamps have come on to the market.

Reduce lighting power allowances to 0.95 W/ft^2 for office and to 2.7 W/ft^2 (1.5 + 1.2) for retail spaces over 3,000 ft^2, insert "ceramic metal halide and other" HID.

Proposal: Amend 2006 WSEC as follows –

TABLE 15-1
UNIT LIGHTING POWER ALLOWANCE (LPA)

Use[1]	**LPA**[2] **(W/ft^2)**
Automotive facility	0.9
Convention center	1.2
Courthouse	1.2
Cafeterias, fast food establishments[5], restaurants/bars[5]	1.3
Dormitory	1.0
Exercise center	1.0
Gymnasia[9], assembly spaces[9]	1.0
Health care clinic	1.0
Hospital, nursing homes, and other Group I-1 and I-2 Occupancies	1.2
Hotel/motel	1.0
Hotel banquet/conference/exhibition hall[3,4]	2.0
Laboratory spaces (all spaces not classified "laboratory" shall meet office and other appropriate categories)	1.8
Laundries	1.2
Libraries[5]	1.3
Manufacturing facility	1.3
Museum	1.1

Office buildings, office/administrative areas in facilities of other use types (including but not limited to schools, hospitals, institutions, museums, banks, churches)[5,7,11]	0.95 ((~~1.0~~))
Parking garages	0.2
Penitentiary and other Group I-3 Occupancies	1.0
Police and fire stations[8]	1.0
Post office	1.1
Retail[10], retail banking, mall concourses, wholesale stores (pallet rack shelving)	1.5
School buildings (Group E Occupancy only), school classrooms, day care centers	1.2
Theater, motion picture	1.2
Theater, performing arts	1.6
Transportation	1.0
Warehouses[11], storage areas	0.5
Workshop	1.4
Plans Submitted for Common Areas Only[7]	
Main floor building lobbies[3] (except mall concourses)	1.2
All building common areas, corridors, toilet facilities and washrooms, elevator lobbies, including Group R-1 and R-2 Occupancies	0.8

Footnotes For Table 15-1

1. In cases in which a general use and a specific use are listed, the specific use shall apply. In cases in which a use is not mentioned specifically, the *Unit Lighting Power Allowance* shall be determined by the building official. This determination shall be based upon the most comparable use specified in the table. See Section 1512 for exempt areas.

2. The watts per square foot may be increased, by 2% per foot of ceiling height above 20 feet, unless specifically directed otherwise by subsequent footnotes.

3. The watts per square foot of room may be increased by 2% per foot of ceiling height above 12 feet.

4. For all other spaces, such as seating and common areas, use the *Unit Lighting Power Allowance* for assembly.

5. The watts per square foot of room may be increased by 2% per foot of ceiling height above 9 feet.

6. Reserved.

7. For conference rooms and offices less than 150 ft^2 with full-height partitions, a Unit Lighting Power Allowance of 1.1 w/ft^2 may be used.

8. Reserved.

9. For indoor sport tournament courts with adjacent spectator seating over 5,000, the *Unit Lighting Power Allowance* for the court area is 2.60 W/ft^2.

10. Display window illumination installed within 2 feet of the window, provided that the display window is separated from the retail space by walls or at least three-quarter-height partitions (transparent or opaque) and lighting for free-standing display where the lighting moves with the display are exempt.

An additional 1.5 W/ft^2 of merchandise display luminaires are exempt for individual tenant spaces less than 3,000 gross square feet and 1.2 W/ft^2 for larger tenants provided that they comply with all three of the following:

a. located on ceiling-mounted track or directly on or recessed into the ceiling itself (not on the wall),

b. adjustable in both the horizontal and vertical axes (vertical axis only is acceptable for fluorescent and other fixtures with two points of track attachment),

c. fitted with LED, tungsten halogen, fluorescent, ceramic metal halide or other high intensity discharge lamps.

This additional lighting power is allowed only if the lighting is actually installed.

11. Provided that a floor plan, indicating rack location and height, is submitted, the square footage for a warehouse may be defined, for computing the interior *Unit Lighting Power Allowance*, as the floor area not covered by racks plus the vertical face area (access side only) of the racks. The height allowance defined in footnote 2 applies only to the floor area not covered by racks.

RS-29, 3.3 HVAC Systems and Equipment.

Discussion: (1) Standard Design glazing area to be same as proposed or, if the Proposed Design exceeds the maximum in Table 13-1, then the maximum allowed in Table 13-1;
(2) Standard Design to use metal stud wall construction.

Proposal: Amend 2006 WSEC as follows -

3.3.1 Insulation and Glazing: Glazing area and U-factor of the standard building envelope shall be determined by using the Target UA requirements of Equation 13-1 and U-factor values in Table 13-1 or 13-2. The glazing solar heat gain coefficient (SHGC) (()) of the standard building shall be the lesser of 0.65 and the SHGC required by Table 13-1 or 13-2 for the vertical or overhead glazing area for the appropriate wall type. The opaque area U-factors of the standard building shall be determined by using the Target UA requirements from Equation 13-1((~~including the appropriate mass for walls~~)), except that the walls in the standard design shall be metal stud walls. The insulation characteristics and glazing area are prescribed assumptions for the standard building for calculating the standard energy consumption. In the calculation of the proposed energy consumption of the proposed design, the envelope characteristics of the proposed design shall be used. The standard design shall use the lesser of the glazing area of the proposed design or the maximum glazing areas listed in Tables 13-1 or 13-2 for the appropriate use. The distribution of vertical glazing in the gross wall area of the standard design shall be equal to the distribution of vertical glazing in the proposed design or shall constitute an equal percentage of gross wall area on all sides of the standard building. The distribution of overhead glazing in the gross roof/ceiling area of the standard design shall be equal to the distribution of overhead glazing in the proposed design. The distribution of doors in the gross opaque wall area of the standard design shall be identical to the distribution of doors in the proposed design.

RS-29, 3.4 HVAC Systems and Equipment.

Discussion: (1) No Seattle changes (retain existing Seattle amendment);
(2) Revise Standard Design fan system to comply with ASHRAE Standard 90.1, addendum ac;
(3) Eliminate automatic credit for underfloor systems.

Proposal: Amend 2006 WSEC as follows -

3.4 HVAC Systems and Equipment: For the standard building, the HVAC system used shall be the system type used in the proposed design. If the proposed HVAC system type does not comply with Sections 1432 through 1439, the standard design system shall comply in all respects with those sections.

EXCEPTION: ((~~When approved by the building official, a~~)) A prototype HVAC system may be used((~~, if the proposed design system cannot be modified to comply with Sections 1422 and 1432 through 1439,~~)) as a standard design. Use of prototype HVAC systems shall only be permitted for the building types listed below. For mixed-use buildings, the floor space of each building type is allocated within the floor space of the standard building. The specifications and requirements for the HVAC systems of prototype buildings shall be those in Table 3-3.

1. assembly
2. health/institutional
3. hotel/motel
4. light manufacturing
5. office (business)
6. restaurant
7. retail (mercantile)
8. school (educational)
9. warehouse (storage)

3.4.1 HVAC Zones: HVAC zones for calculating the standard energy consumption and proposed energy consumption shall consist of at least four perimeter and one interior zone per floor, with at least one perimeter zone facing each orientation. The perimeter zones shall be 15 feet in width or one-third the narrow dimension of the

building when this dimension is between 30 and 45 feet inclusive, or half the narrow dimension of the building when this dimension is less than 30 feet.

EXCEPTIONS: 1. Building types such as assembly or warehouse may be modeled as a single zone if there is only one space.

2. Thermally similar zones, such as those facing one orientation on different floors, may be grouped together for the purposes of either the standard or proposed building simulation.

3.4.2 Process Equipment Sizing: Process sensible and latent loads shall be equal in calculating both the standard energy consumption and the proposed energy consumption. The designer shall document the installation of process equipment and the size of process loads.

3.4.3 HVAC Equipment Sizing: The equipment shall be sized to include the capacity to meet the process loads. For calculating the proposed energy consumption, actual air flow rates and installed equipment size shall be used in the simulation. Equipment sizing in the simulation of the proposed design shall correspond to the equipment intended to be selected for the design and the designer shall not use equipment sized automatically by the simulation tool.

Equipment sizing for the standard design shall be based on the same as the proposed design or lesser sizing ratio of installed system capacity to the design load for heating and for cooling.

Chilled water systems for the standard building shall be modeled using a reciprocating chiller for systems with total cooling capacities less than 175 tons, and centrifugal chillers for systems with cooling capacities of 175 tons or greater. For systems with cooling capacities of 600 tons or more, the standard energy consumption shall be calculated using two centrifugal chillers, lead/lag controlled. Chilled water shall be assumed to be controlled at a constant 44°F temperature rise, from 44°F to 56°F, operating at 65 % combined impeller and motor efficiency. Condenser water pumps shall be sized using a 10°F temperature rise, operating at 60% combined impeller and motor efficiency. The cooling tower shall be an open circuit, centrifugal blower type sized for the larger of 85°F leaving water temperature or 10°F approach to design wetbulb temperature. The tower shall be controlled to provide a 65°F leaving water temperature whenever weather conditions permit, floating up to design leaving water temperature at design conditions.

3.4.4 Fans: ((~~The power of the combined fan system per air volume at design conditions (w/cfm) of the proposed design shall be equal to that of t~~))The standard design shall comply with the following.

3.4.4.1 Fan System Power Limitation: Each HVAC system at fan system design conditions shall not exceed the allowable fan system motor nameplate hp [Option 1] or fan system bhp [Option 2] as shown in the Fan Power Limitation table. This includes supply fans, return/relief fans, exhaust fans, and fan-powered terminal units associated with systems providing heating or cooling capability.

Fan Power Limitation

	Limit	**Constant Volume**	**Variable Volume**
Option 1: Fan System Motor Nameplate hp	Allowable Nameplate Motor hp	hp≤ CFMS*0.0011	hp≤ CFMS*0.0015
Option 2: Fan System bhp	Allowable Fan System bhp	bhp≤ CFMS * 0.00094 + A	bhp≤ CFMS * 0.0013 + A

where:

fan brake horsepower = the horsepower delivered to the fan's shaft. Brake horsepower does not include the mechanical drive losses (belts, gears, etc.).

fan system design conditions = operating conditions that can be expected to occur during normal system operation that result in the highest supply airflow rate to conditioned spaces served by the system.

fan system bhp = the sum of the fan brake horsepower of all fans that are required to operate at fan system design conditions to supply air from the heating or cooling source to the conditioned space(s) and return it to the source or exhaust it to the outdoors.

fan system motor nameplate hp = the sum of the motor nameplate horsepower of all fans that are required to operate at design conditions to supply air from the heating or cooling source to the conditioned space(s) and return it to the source or exhaust it to the outdoors.

nameplate horsepower = the nominal motor horsepower rating stamped on the motor nameplate.

CFMS = the maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute

hp = the maximum combined motor nameplate horsepower

bhp = the maximum combined fan brake horsepower

A = Sum of [PD x CFMD / 4131]

where:

PD = Each applicable pressure drop adjustment from Table 14-8 in in. w.c.

CFMD = the design air flow through each applicable device from Table 14-8 in cubic feet per minute

Exceptions:
(a). Hospital and laboratory systems that utilize flow control devices on exhaust and/or return to maintain space pressure relationships necessary for occupant health and safety or environmental control may use variable volume fan power Limitation.
(b). Individual exhaust fans with motor nameplate horsepower of 1 hp or less.
(c) Fans exhausting air from fume hoods. (Note: If this exception is taken, no related exhaust side credits shall be taken from the table below and the Fume Exhaust Exception Deduction shall be taken from the table below).

Fan Power Limitation Pressure Drop Adjustment

Device	**Adjustment**
Credits	
Fully ducted return and/or exhaust air systems	0.5 in w.c.
Return and/or exhaust air flow control devices	0.5 in w.c.
Exhaust filters, scrubbers, or other exhaust treatment.	Pressure drop of device at fan system design condition
Particulate filtration credit: MERV 9	0.5 in w.c.

thru 12	
Particulate filtration credit: MERV 13 thru 15	0.9 in w.c.
Particulate filtration credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2x clean filter pressure drop at fan system design condition
Carbon and other gas-phase air cleaners	Clean filter pressure drop at fan system design condition
Heat recovery device	Pressure drop of device at fan system design condition
Evaporative humidifier/cooler in series with another cooling coil	Pressure drop of device at fan system design condition
Sound attenuation section	0.15 in w.c.
Deductions	
Fume hood exhaust exception (required if 1438.2.1 exception (c) is taken)	-1.0 in w.c.

3.4.4.2 Motor Nameplate Horsepower: For each fan, the selected fan motor shall be no larger than the first available motor size greater than the brake horsepower. The fan brake horsepower must be indicated on the design documents to allow for compliance verification by the code official.

Exceptions:
(a) For fans less than 6 bhp, where the first available motor larger than the brake horsepower has a nameplate rating within 50% of the brake horsepower, the next larger nameplate motor size may be selected.

(b) For fans 6 bhp and larger, where the first available motor larger than the brake horsepower has a nameplate rating within 30% of the brake horsepower, the next larger nameplate motor size may be selected.

3.4.4.3 Variable Speed: Variable air volume fan systems in the standard building shall be variable speed.

RS-29, 3.6 Controls.

Discussion: No Seattle changes (retain existing Seattle amendment).
Proposal: Amend 2006 WSEC as follows -

3.6 Controls

3.6.1: All occupied conditioned spaces in standard and proposed design buildings in all climates shall be simulated as being both heated and cooled.

EXCEPTIONS: 1. If a building or portion of a building is to be provided with only heating or cooling, both the standard building and the proposed design shall be simulated using the same assumptions.

2. If warehouses are not intended to be mechanically cooled, both the standard and proposed energy consumption shall be modeled assuming no mechanical cooling.

3.6.2: Space temperature controls for the standard building shall be set at 70°F for space heating and 75°F for space cooling, with a deadband in accordance with Section 1412.2. The system shall be OFF during off-hours according to the appropriate schedule in Table 3-2, except that the heating system shall cycle ON if any space should drop below the night setback setting 55°F.

There shall be no similar setpoint during the cooling season. Lesser deadband ranges may be used in calculating the proposed energy consumption.

EXCEPTIONS: 1. Setback shall not be modeled in determining either the standard or proposed energy 2. If deadband controls are not to be installed, the proposed energy consumption shall be calculated with both heating and cooling thermostat setpoints set to the same value between 70°F and 75°F inclusive, assumed to be constant for the year.

3.6.3: When providing for outdoor air ventilation when calculating the standard energy consumption, controls shall be assumed to close the outside air intake to reduce the flow of outside air to 0.0 cfm during "setback" and "unoccupied" periods. Ventilation using inside air may still be required to maintain scheduled setback temperature. Outside air ventilation, during occupied periods, shall be as required by the Washington State Ventilation and Indoor Air Quality Code, Chapter 51-13 WAC.

3.6.4: If humidification is to be used in the proposed design, the same level of humidification and system type shall be used in the standard building.

3.6.5: There shall be no credit in the proposed design for control of parking garage ventilation.

RS-29, Table 3-3, HVAC Systems of Prototype Buildings.

Discussion: (1) No Seattle changes (retain existing Seattle amendment),
(2) Electric resistance space heat not allowed in Standard Design,
(3) Chilled water systems in the Standard Design to be water-chilled.

Proposal: Amend 2006 WSEC as follows -

TABLE 3-3
HVAC Systems of Prototype Buildings[3]

Use	System #	Remarks
1. Assembly		
a. Churches (any size)	1	
b. ≤ 50,000 ft^2 or ≤ 3 floors	1 or 3	Note 2
c. > 50,000 ft^2 or > 3 floors	3	
2. Health		
a. Nursing Home (any size)	2	
b. ≤ 15,000 ft^2	1	
c. > 15,000 ft^2 and ≤ 50,000 ft^2	4	Note 3
d. > 50,000 ft^2	5	Note 3,4
3. Hotel/Motel		
a. ≤ ((~~3~~)) 6 Stories	2	Note 6
b. > ((~~3~~)) 6 Stories	6	Note 7
~~4.~~ Light Manufacturing	1 or 3	
5. Office		
a. ≤ 20,000 ft^2	1	
b. > 20,000 ft^2 and ((~~either~~)) ≤ ((~~3~~)) 7 floors ((~~or ≤ 75,000 ft^2~~))	4	
c. > ((~~75,000 ft^2 or > 3~~)) 7 floors	5	
6. Restaurant	1 or 3	Note 2
7. Retail		
a. ≤ 50,000 ft^2	1 or 3	Note 2
b. > 50,000 ft^2	4 or 5	Note 2
8. Schools		
a. ≤ 75,000 ft^2 or ≤ 3 floors	1	
b. > 75,000 ft^2 or > 3 floors	3	

9. Warehouse		Note 5

Footnote to Table 3-3: The systems and energy types presented in this table are not intended as requirements or recommendations for the proposed design. Floor areas in the table are the total conditioned floor areas for the listed use in the building. The number of floors indicated in the table is the total number of occupied floors for the listed use.

TABLE 3-3 (Continued)
HVAC System Descriptions for Prototype Buildings[1]

HVAC Component	System #1	System #2
System Description	Packaged rooftop single zone, one unit per zone	Packaged terminal air conditioner with space heater or heat pump, heating or cooling unit per zone
Fan system Design Supply Circulation Rate	Note 10	Note 11
Supply Fan Control	Constant volume	Fan cycles with call for heating or cooling
Return Fan Control	NA	NA
Cooling System	Direct expansion air cooled	Direct expansion air cooled
Heating System	Furnace, heat pump ((~~or electric resistance~~))	Heat pump with electric resistance auxiliary or air conditioner with space heater
Remarks	Drybulb economizer per Section 1433, heat recovery if required by Section 1436	No economizer, if not required by Section 1433

TABLE 3-3 (Continued)
HVAC System Descriptions for Prototype Buildings[1]

HVAC Component	System #3	System #4
System Description	Air handler per zone with central plant	Packaged rooftop VAV with perimeter reheat and fan-powered terminal units
Fan system Design Supply Circulation Rate	Note 10	Note 10
Supply Fan Control	Constant volume	Variable Air Volume systems with controls per Section 1438 ((~~forward curved centrifugal fan and variable inlet fans~~))
Return Fan Control	Constant volume	Variable Air Volume systems with controls per Section 1438 ((~~forward curved centrifugal fan and variable inlet fans~~))
Cooling System	Water-cooled Chilled water (Note 12)	Direct expansion air cooled
Heating System	Hot water (Note 13)	Hot water (Note 13) or electric resistance
Remarks	Drybulb economizer per Section 1433, heat recovery if required by Section 1436	Drybulb economizer per Section 1433. Minimum VAV setting per Section 1435 Exception 1, Supply air reset by zone of greatest cooling demand, heat recovery if required by Section 1436

TABLE 3-3 (Continued)
HVAC System Descriptions for Prototype Buildings[1]

HVAC Component	System #5	System #6
System Description	Built-up central VAV with perimeter reheat and fan-powered terminal units	Four-pipe fan coil per zone with central plant
Fan system Design Supply Circulation Rate	Note 10	Note 10
Supply Fan Control	VAV with air-foil centrifugal fan and AC frequency variable speed drive	Fan cycles with call for heating or cooling
Return Fan Control	VAV with air-foil centrifugal fan and AC frequency variable speed drive	NA
Cooling System	Water-cooled Chilled water (Note 12)	Water-cooled Chilled water (Note 12)
Heating System	Hot water (Note 13) or electric resistance	Hot water (Note 13) or electric resistance
Remarks	Drybulb economizer per Section 1433. Minimum VAV setting per Section 1435 Exception 1, Supply air reset by zone of greatest cooling demand, heat recovery if required by Section 1436	No economizer, if not required by Section 1433

Numbered Footnotes for Table 3-3
HVAC System Descriptions for Prototype Buildings

1. The systems and energy types presented in this Table are not intended as requirements or recommendations for the proposed design.
2. For occupancies such as restaurants, assembly and retail that are part of a mixed use building which, according to Table 3-3, includes a central chilled water plant (systems 3, 5, or 6), chilled water system type 3 or 5 shall be used as indicated in the table.
3. Constant volume may be used in zones where pressurization relationships must be maintained by code. Where constant volume is used, the system shall have heat recovery if required by Section 1436. VAV shall be used in all other areas, in accordance with Sections 1432 through 1439.
4. Provide run-around heat recovery systems for all fan systems with a minimum outside air intake greater than 70%. Recovery effectiveness shall be 0.50.
5. If a warehouse is not intended to be mechanically cooled, both the standard and proposed designs shall be calculated assuming no mechanical cooling.
6. The system listed is for guest rooms only. Areas such as public areas and back-of-house areas shall be served by system 4. Other areas such as offices and retail shall be served by systems listed in Table 3-3 for these occupancy types.
7. The system listed is for guest rooms only. Areas such as public areas and back-of- house areas shall be served by system 5. Other areas such as offices and retail shall be served by systems listed in Table 3-3 for these occupancy types.
8. Reserved.
9. Reserved.
10. Design supply air circulation rate shall be based on a supply-air to room-air temperature difference of 20°F. A higher supply-air temperature may be used if required to maintain a minimum circulation rate of 4.5 air changes per hour or 15 cfm per person to each zone served by the system, at design conditions. If return fans are specified, they shall be sized for the supply fan capacity less the required minimum ventilation with outside air, or 75% of the supply fan capacity, whichever is larger. Except where noted, supply and return fans shall be operated continuously during occupied hours.
11. Fan energy when included in the efficiency rating of the unit as defined in Section 1411, need not be modeled explicitly for this system. The fan shall cycle with calls for heating or cooling.
12. Chilled water systems shall be modeled using a reciprocating chiller for systems with total cooling capacities less than 175 tons, and centrifugal chillers for systems with cooling capacities of 175 tons or greater. For systems with cooling capacities of 600 tons or more, the standard design energy consumption shall be calculated using two centrifugal chillers, lead/lag controlled. Chilled water shall be assumed to be controlled at a constant 44°F. Chiller water pumps shall be sized using a 12°F temperature rise, from 44°F to 56°F, operating at 65% combined impeller and motor efficiency. Condenser water pumps shall be sized using a 10°F temperature rise, operating at 60% combined impeller and motor efficiency. The cooling tower shall be an open circuit, centrifugal blower type sized for the larger of 85°F leaving water temperature or 10°F approach to design wetbulb temperature. The tower shall be controlled to provide a 65°F leaving water temperature whenever weather conditions permit, floating up to design leaving water temperatures at design conditions. Chilled water supply temperature shall be reset in accordance with Section 1432.2.2.
13. Hot water system shall include a natural draft fossil fuel or electric boiler. The hot water pump shall be sized based on a 30°F temperature drop, from 180°F to 150°F, operating at a combined impeller and motor efficiency of 60%. Hot water supply temperature shall be reset in accordance with Section 1432.2.2.